

FIG. 1  
(PRIOR ART)

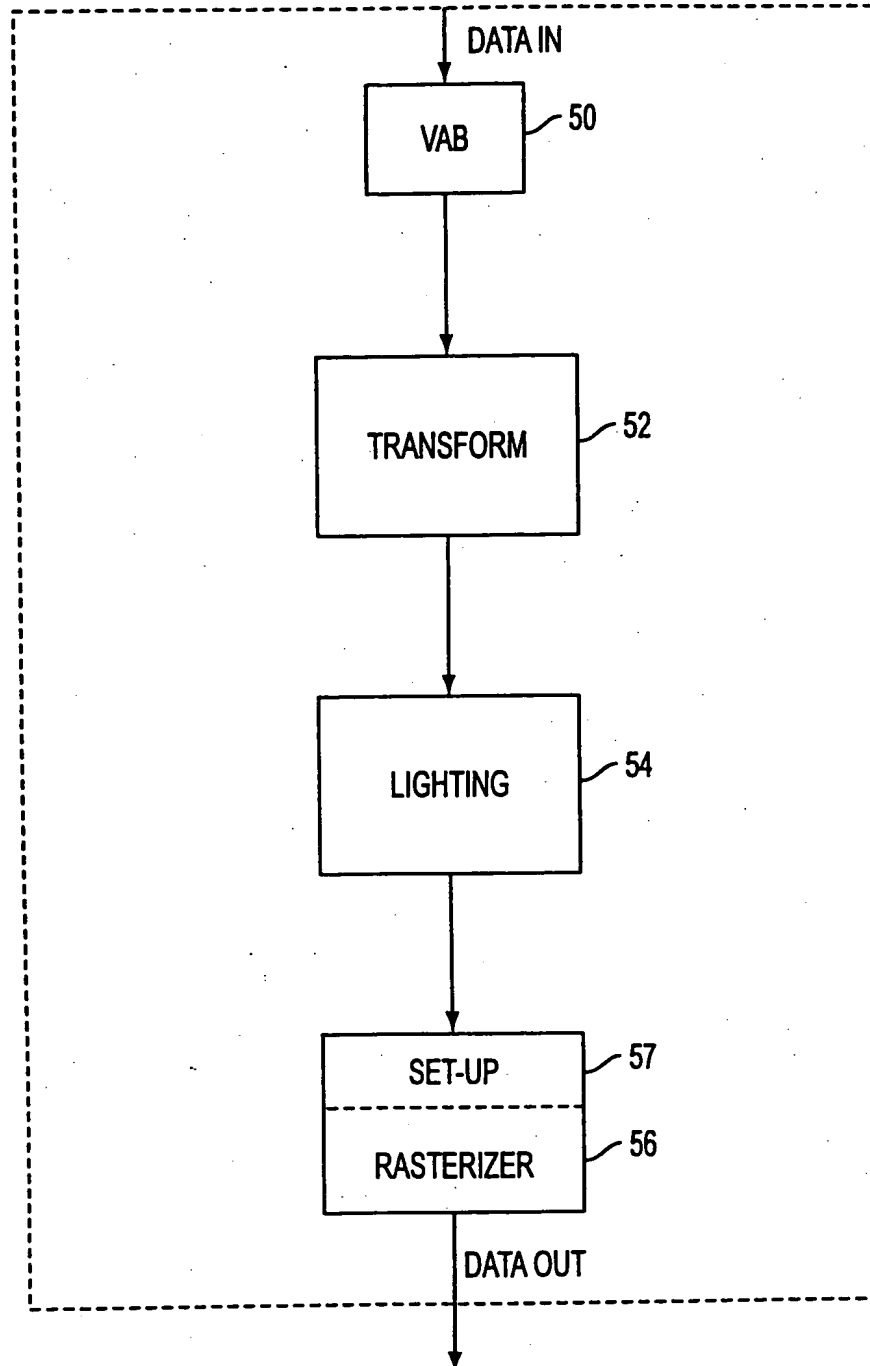
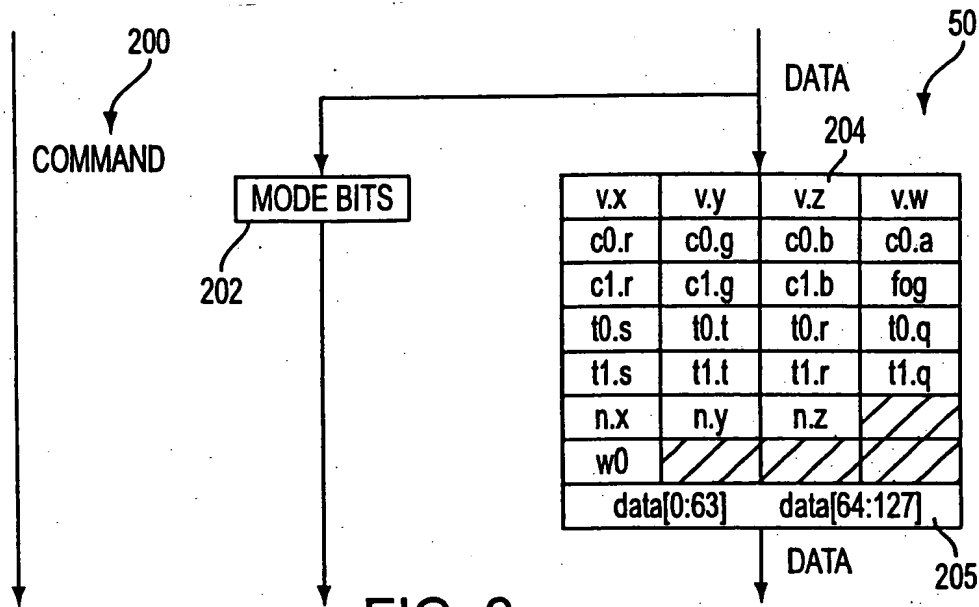


FIG. 1A



**FIG. 2**

**COMMAND**      **TRANSFORM STALL**      **LIGHTING STALL**      **DESCRIPTION**

FE2XF_CMD_NOP			NO OPERATION. CAN BE USED AS A SPACER BETWEEN COMMANDS.
FE2XF_CMD_VERTEX	READ	READ	VERTEX DATA.
FE2XF_CMD_PASSTHR			PASSTHROUGH. TRANSFORM AND LIGHTING PASS THE DATA THROUGH.
FE2XF_CMD_RDVAB			READ THE VAB CONTENTS WHEN CONTEXT SWITCHING.
FE2XF_CMD_LDMODE			LOAD NEW MODE BITS.
FE2XF_CMD_LDXFCTX	WRITE		LOAD TRANSFORM CONTEXT MEMORY DATA.
FE2XF_CMD_RDXFCTX	READ		READ TRANSFORM CONTEXT MEMORY DATA.
FE2XF_CMD_LDLTCTX		WRITE	LOAD LIGHTING CONTEXT MEMORY DATA.
FE2XF_CMD_RDLTCTX		READ	READ LIGHTING CONTEXT MEMORY DATA.
FE2XF_CMD_LDLTC0		WRITE	LOAD LIGHTING CONTEXT0 MEMORY DATA.
FE2XF_CMD_RDLTC0		READ	READ LIGHTING CONTEXT0 MEMORY DATA.
FE2XF_CMD_LDLTC1		WRITE	LOAD LIGHTING CONTEXT1 MEMORY DATA.
FE2XF_CMD_RDLTC1		READ	READ LIGHTING CONTEXT1 MEMORY DATA.
FE2XF_CMD_LDLTC2		WRITE	LOAD LIGHTING CONTEXT2 MEMORY DATA.
FE2XF_CMD_RDLTC2		READ	READ LIGHTING CONTEXT2 MEMORY DATA.
FE2XF_CMD_LTLTC3		WRITE	LOAD LIGHTING CONTEXT3 MEMORY DATA.
FE2XF_CMD_RDLTC3		READ	READ LIGHTING CONTEXT3 MEMORY DATA.
FE2XF_CMD_SYNC	READ+ WRITE	READ+ WRITE	SIMILAR TO NOP, BUT IS NOT ALLOWED TO BE PROCESSED IN PARALLEL.

**FIG. 2A**

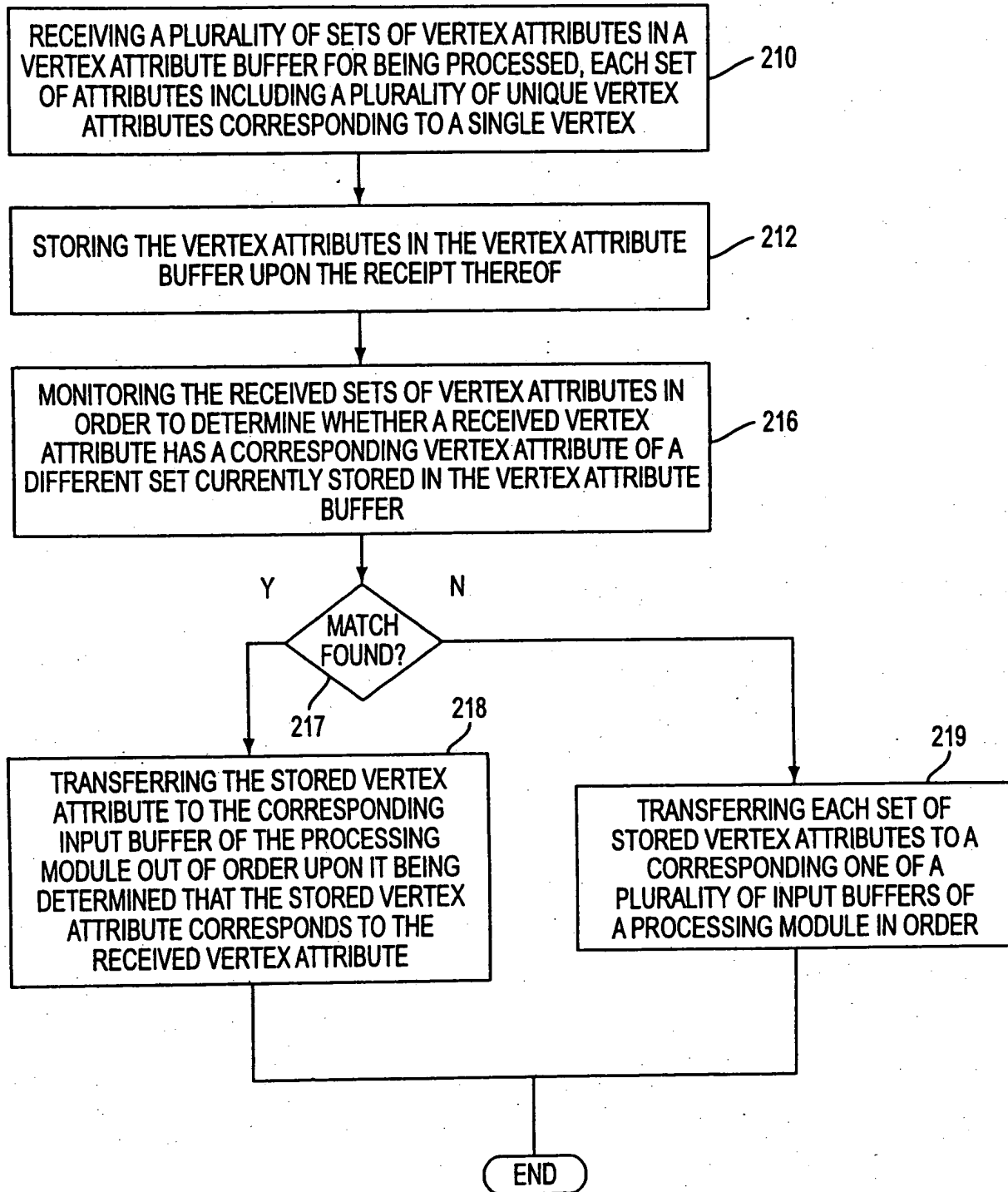


FIG. 2B

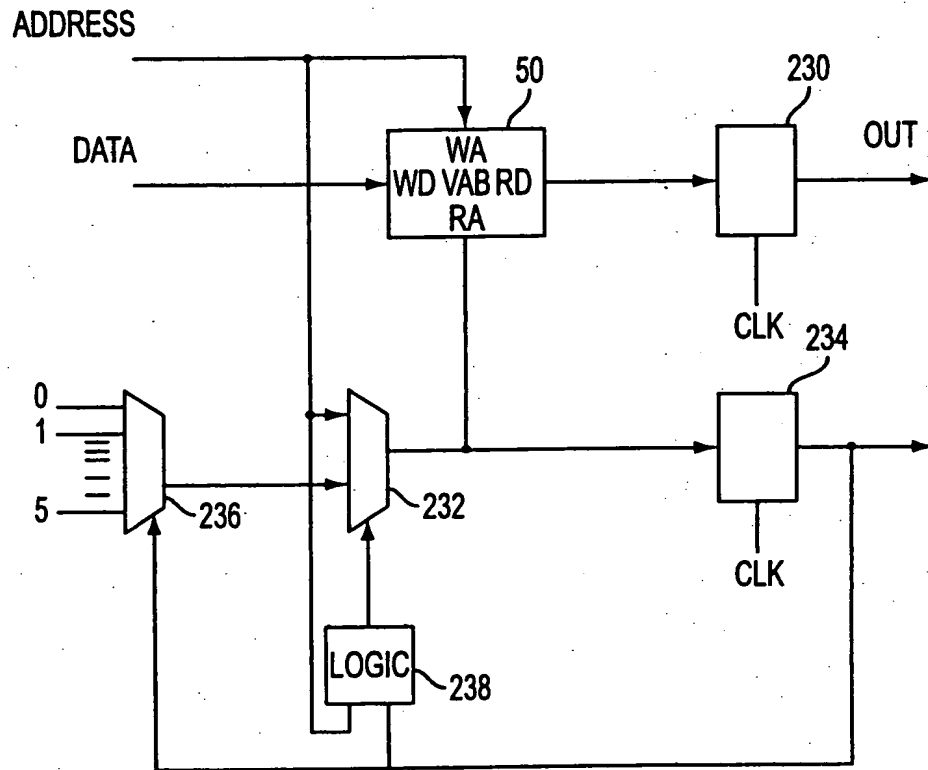


FIG. 2C

MODE BIT	BITS	DESCRIPTION
T0	1	TEXTURE 0 ENABLE
TXF0	1	TEXTURE 0 MATRIX TRANSFORM ENABLE
TDV0	1	TEXTURE 0 w DIVIDE ENABLE
T0S	3	TEXTURE 0 TEXGEN s CONTROL
T0T	3	TEXTURE 0 TEXGEN t CONTROL
T0U	3	TEXTURE 0 TEXGEN r CONTROL
T0Q	2	TEXTURE 0 TEXGEN q CONTROL
T1	1	TEXTURE 1 ENABLE
TXF1	1	TEXTURE 1 MATRIX TRANSFORM ENABLE
TDV1	1	TEXTURE 1 w DIVIDE ENABLE
T1S	3	TEXTURE 1 TEXGEN s CONTROL
T1T	3	TEXTURE 1 TEXGEN t CONTROL
T1U	3	TEXTURE 1 TEXGEN r CONTROL
T1Q	2	TEXTURE 1 TEXGEN q CONTROL
ETY	1	EYE TYPE INFINITE(0) OR LOCAL(1)
LIT	1	LIGHTING ENABLE
NRM	1	NORMAL NORMALIZE ENABLE
FOG	1	FOG ENABLE
LIS	16	LIGHT STATUS ( 8 LIGHTS BY 2 BITS EACH, 0:OFF,1:INFINITE,2:LOCAL,3:SPOTLIGHT)
FG	2	FOGGEN CONTROL(0: OFF, 1:RADIAL, 2: PLANE)
LAT	1	LIGHT ATTENUATION CONTROL (0: INVERT, 1: NO INVERT)
C1I	1	SPECULAR COLOR INPUT ENABLE
C1O	1	SPECULAR COLOR OUTPUT ENABLE
CM	4	COLOR MATERIAL CONTROL (1: EMISSIVE, 2: AMBIENT, 4: DIFFUSE, 8:SPECULAR)
PP	1	POINT PARAMETER ENABLE
SKIN	1	SKINNING ENABLE
VPAS	1	VERTEX PASS ENABLE

FIG. 3

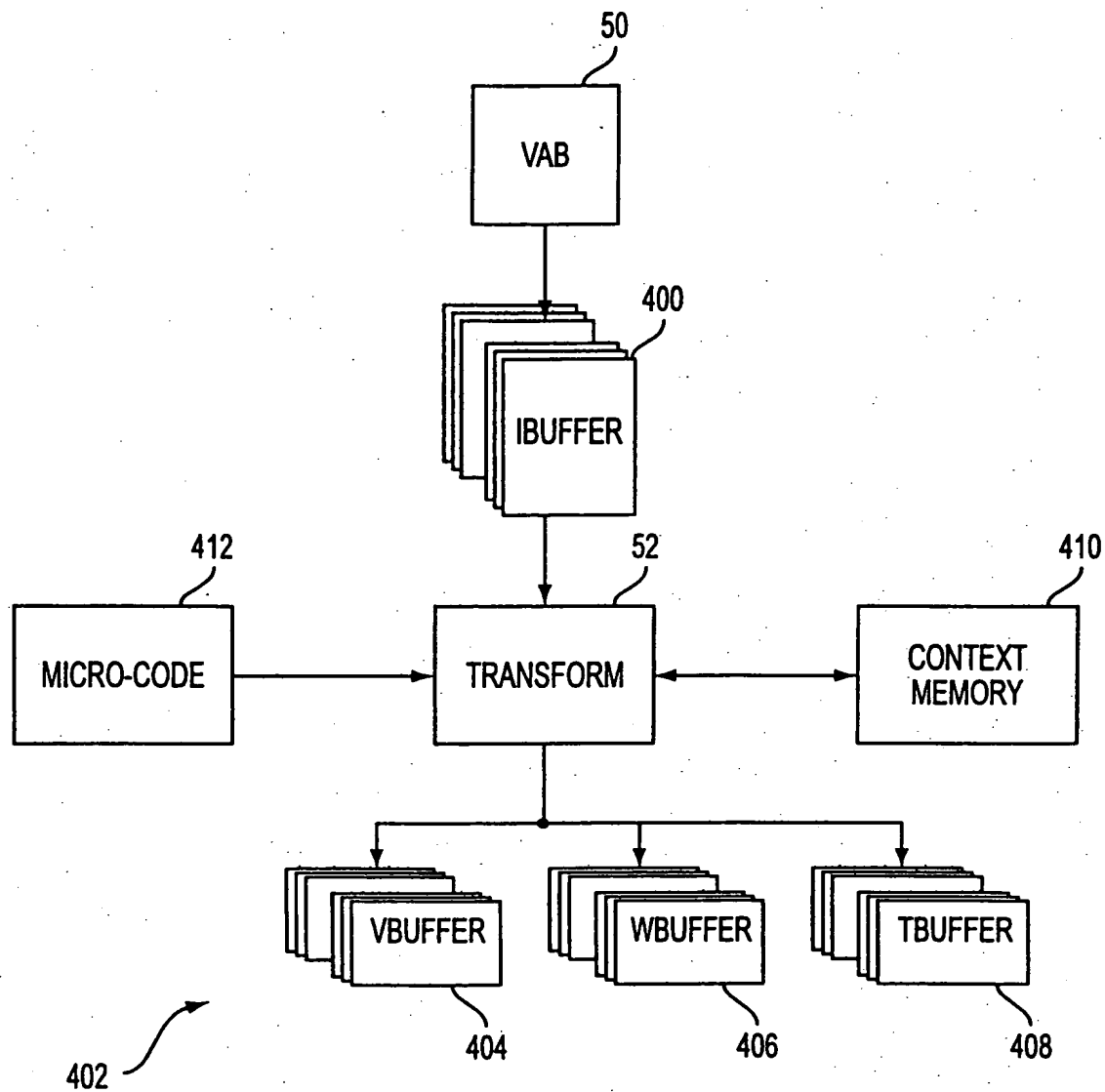


FIG. 4

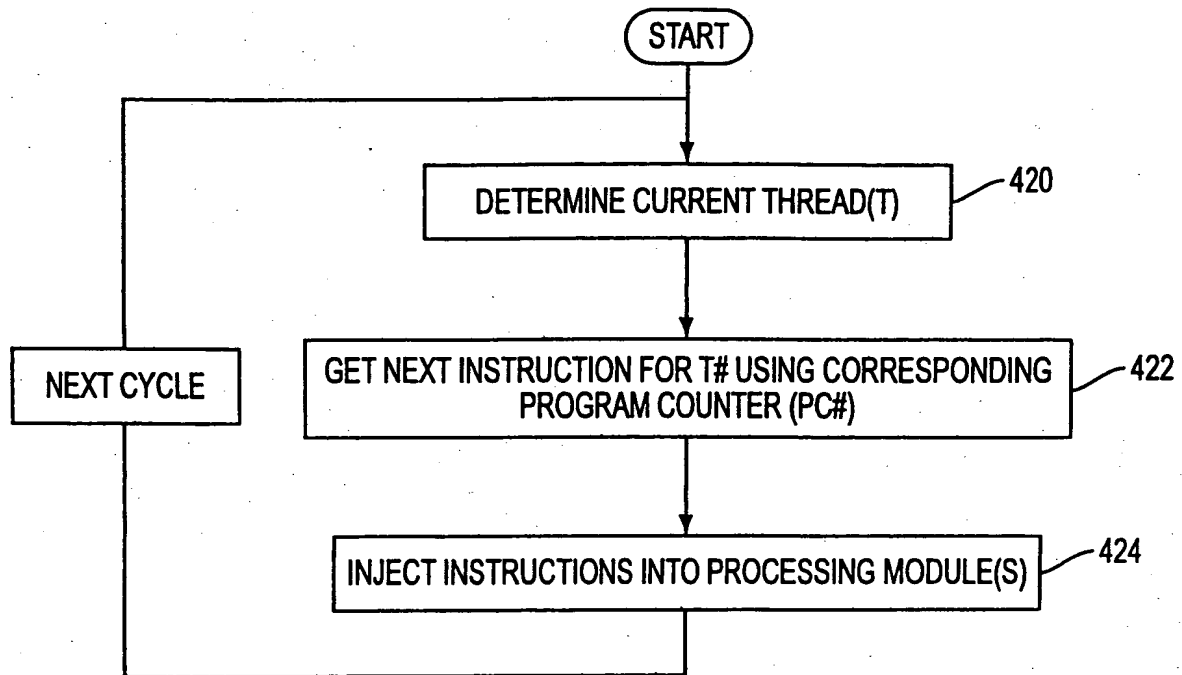


FIG. 4A



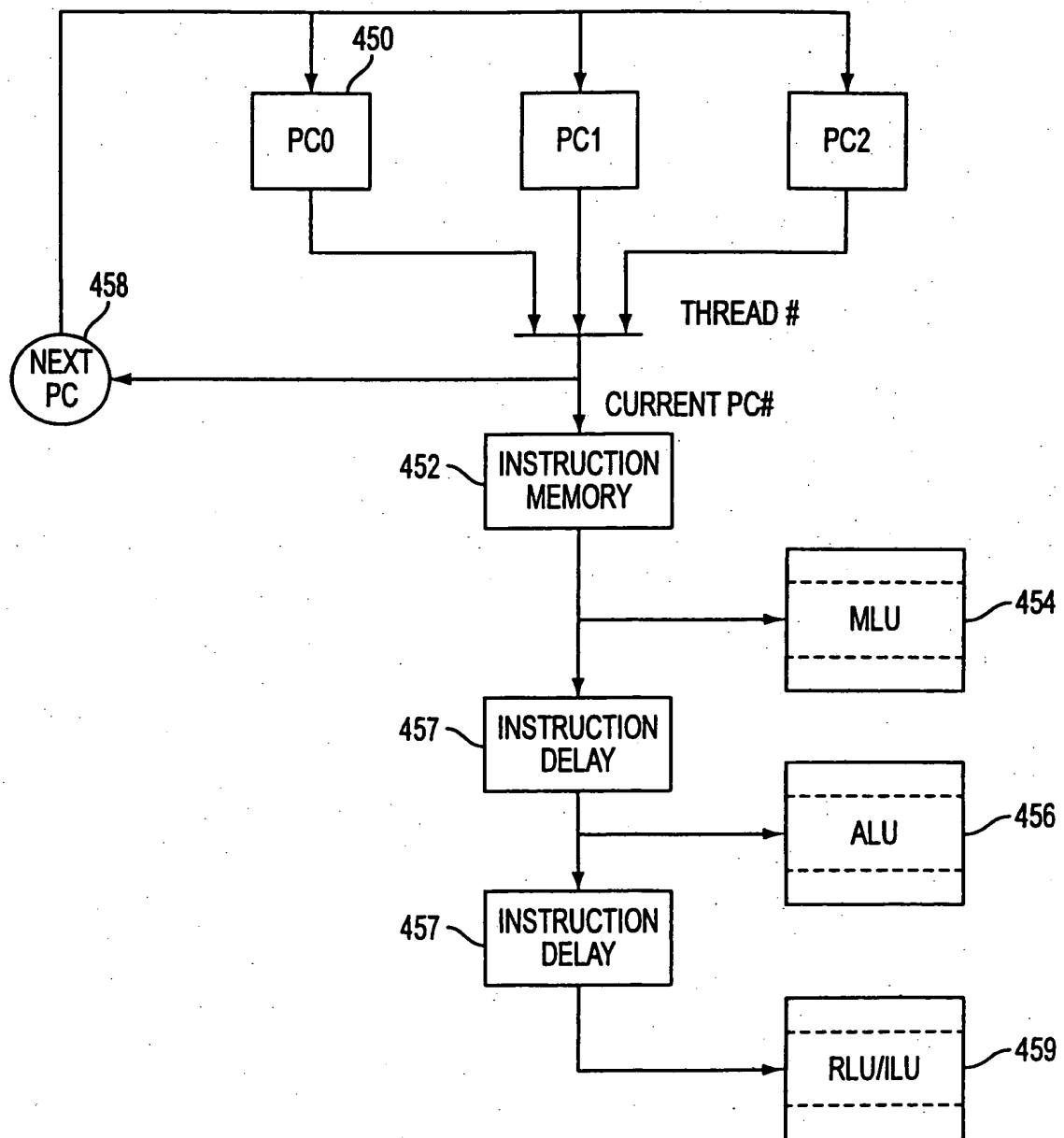


FIG. 4B

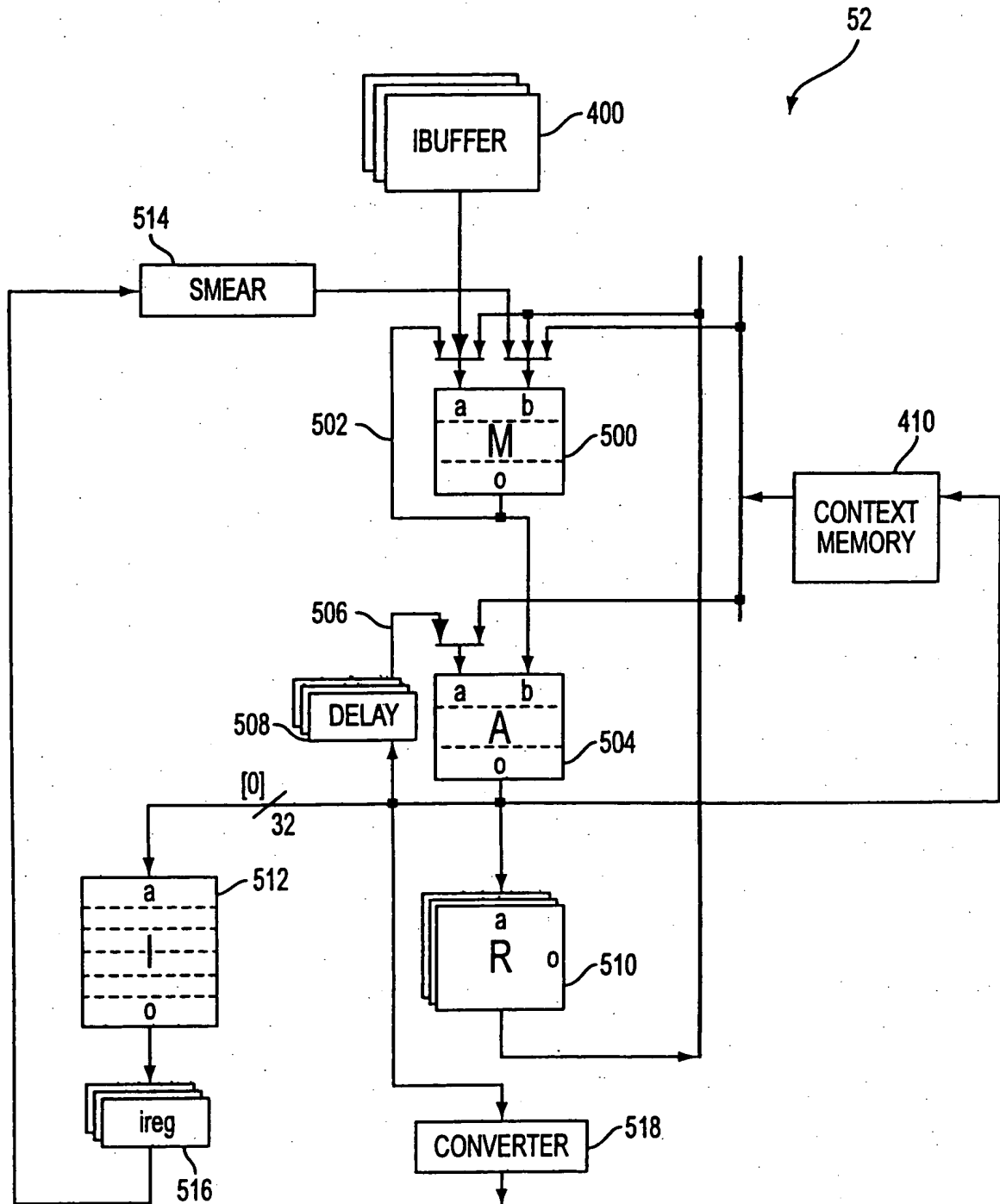
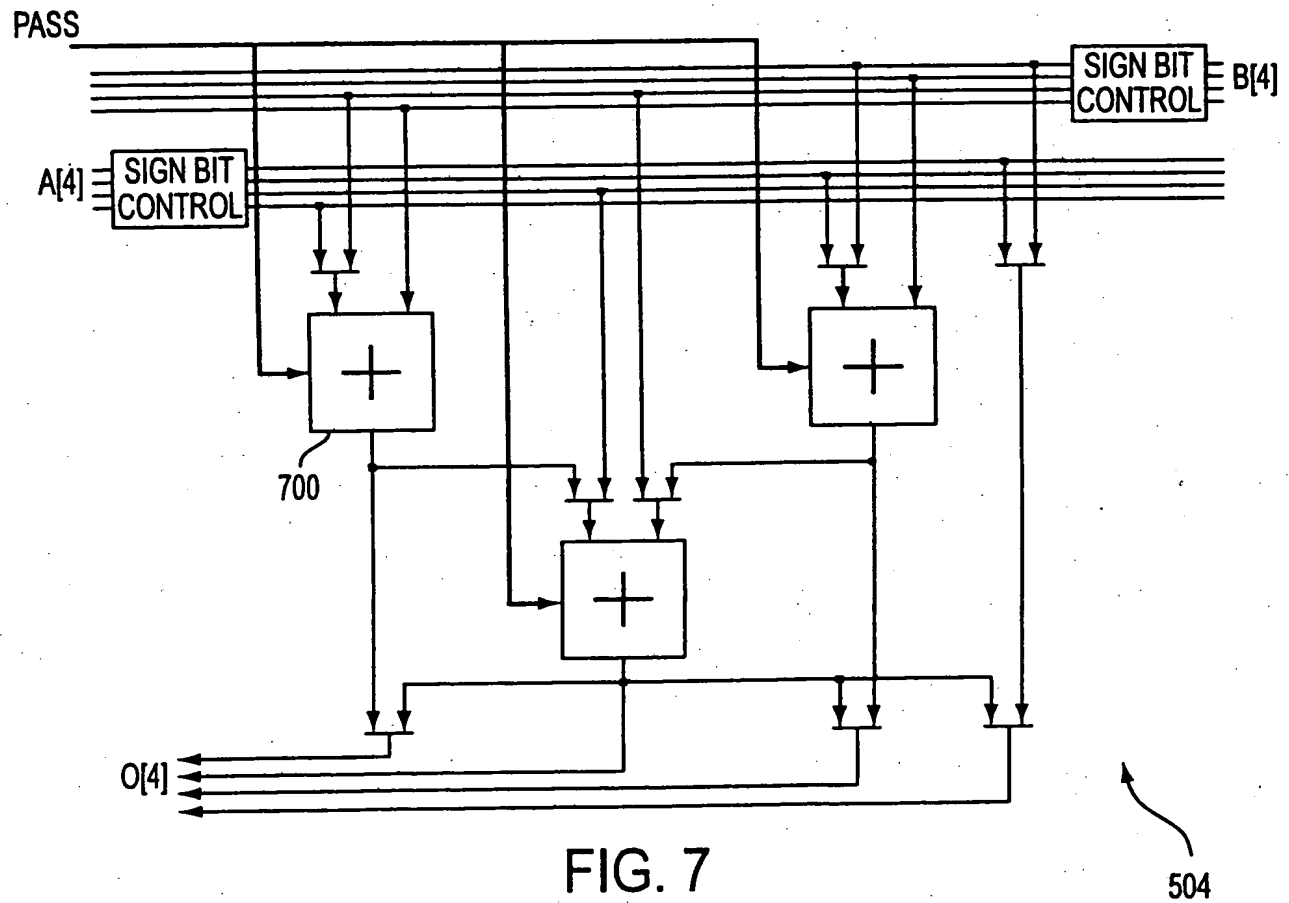
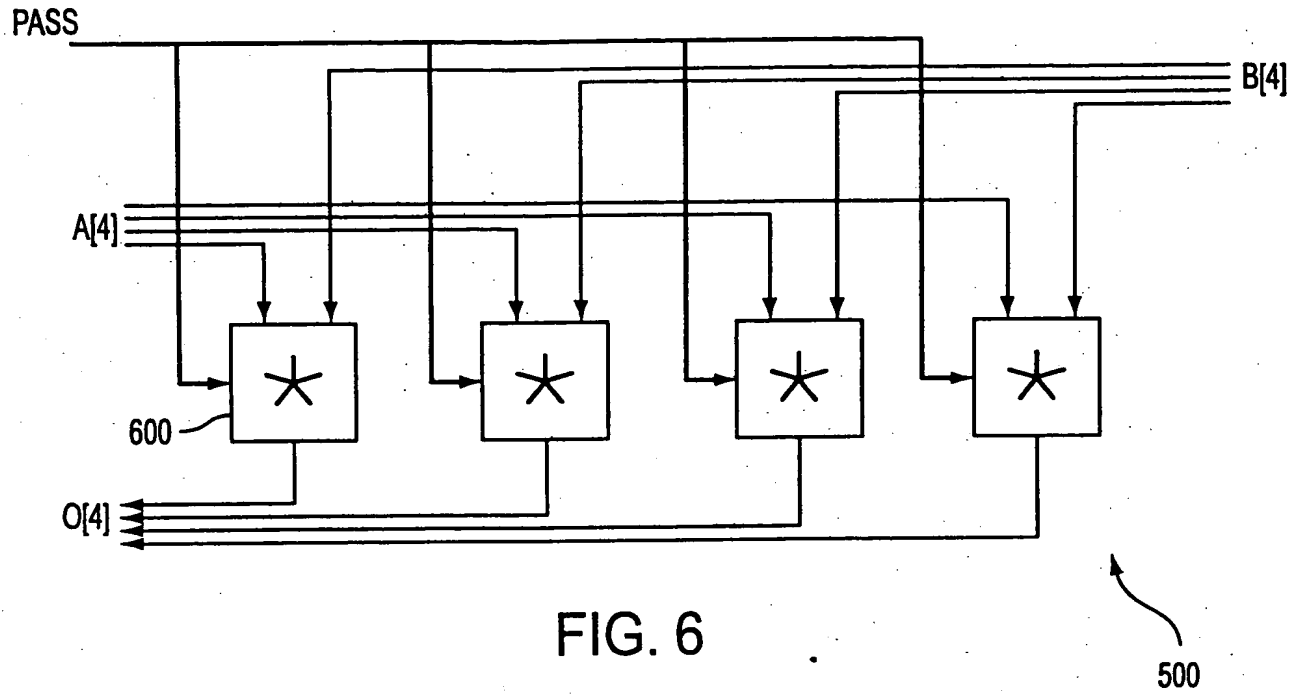


FIG. 5



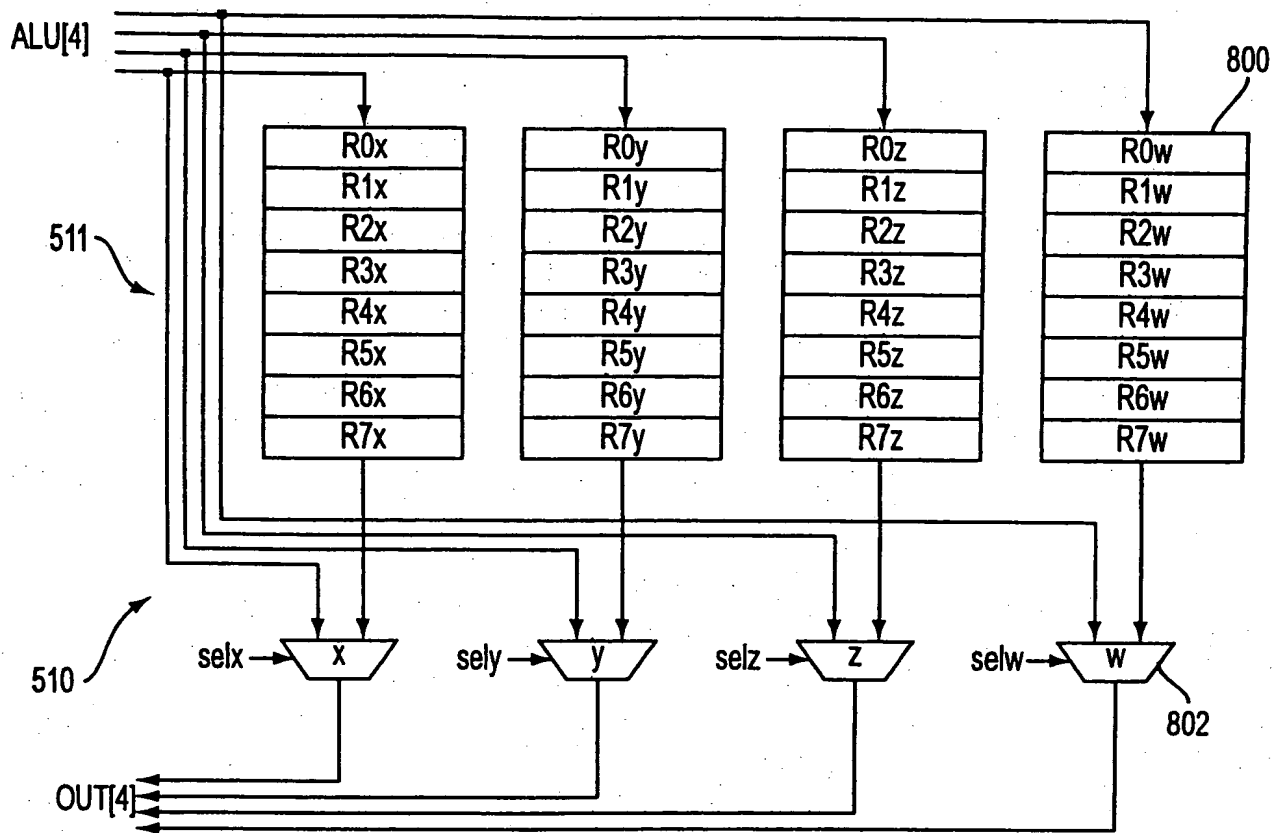


FIG. 8

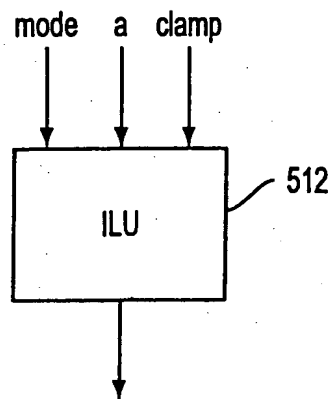


FIG. 9

ADDRESS	TARGET	ACTION	DESCRIPTION
TPOS	TBUFFER	$T[0] = \text{ALU}$	POSITION
TT0	TBUFFER	$T[3] = \text{ALU}$	TEXTURE0
TT1	TBUFFER	$T[4] = \text{ALU}$	TEXTURE1
WEV	WBUFFER,VBUFFER	$W[0] = \text{ALU}, V[0].y = \text{ALU}.w$	EYE VECTOR
WLV0	WBUFFER,VBUFFER	$W[1] = \text{ALU}, V[1].y = \text{ALU}.w$	LIGHT0 DIRECTION VECTOR
WLV1	WBUFFER,VBUFFER	$W[2] = \text{ALU}, V[2].y = \text{ALU}.w$	LIGHT1 DIRECTION VECTOR
WLV2	WBUFFER,VBUFFER	$W[3] = \text{ALU}, V[3].y = \text{ALU}.w$	LIGHT2 DIRECTION VECTOR
WLV3	WBUFFER,VBUFFER	$W[4] = \text{ALU}, V[4].y = \text{ALU}.w$	LIGHT3 DIRECTION VECTOR
WLV4	WBUFFER,VBUFFER	$W[5] = \text{ALU}, V[5].y = \text{ALU}.w$	LIGHT4 DIRECTION VECTOR
WLV5	WBUFFER,VBUFFER	$W[6] = \text{ALU}, V[6].y = \text{ALU}.w$	LIGHT5 DIRECTION VECTOR
WLV6	WBUFFER,VBUFFER	$W[7] = \text{ALU}, V[7].y = \text{ALU}.w$	LIGHT6 DIRECTION VECTOR
WLV7	WBUFFER,VBUFFER	$W[8] = \text{ALU}, V[8].y = \text{ALU}.w$	LIGHT7 DIRECTION VECTOR
WSL0	WBUFFER	$W[9] = \text{ALU}$	SPOTLIGHT0 cos
WSL1	WBUFFER	$W[10] = \text{ALU}$	SPOTLIGHT1 cos
WSL2	WBUFFER	$W[11] = \text{ALU}$	SPOTLIGHT2 cos
WSL3	WBUFFER	$W[12] = \text{ALU}$	SPOTLIGHT3 cos
WSL4	WBUFFER	$W[13] = \text{ALU}$	SPOTLIGHT4 cos
WSL5	WBUFFER	$W[14] = \text{ALU}$	SPOTLIGHT5 cos
WSL6	WBUFFER	$W[15] = \text{ALU}$	SPOTLIGHT6 cos
WSL7	WBUFFER	$W[16] = \text{ALU}$	SPOTLIGHT7 cos
VED	VBUFFER	$V[0].x = 1.0, V[0].z = \text{ALU}.w$	EYE RADIAL DISTANCE VECTOR
VLD0	VBUFFER	$V[1].x = 1.0, V[1].z = \text{ALU}.w$	LIGHT0 DISTANCE VECTOR
VLD1	VBUFFER	$V[2].x = 1.0, V[2].z = \text{ALU}.w$	LIGHT1 DISTANCE VECTOR
VLD2	VBUFFER	$V[3].x = 1.0, V[3].z = \text{ALU}.w$	LIGHT2 DISTANCE VECTOR
VLD3	VBUFFER	$V[4].x = 1.0, V[4].z = \text{ALU}.w$	LIGHT3 DISTANCE VECTOR
VLD4	VBUFFER	$V[5].x = 1.0, V[5].z = \text{ALU}.w$	LIGHT4 DISTANCE VECTOR
VLD5	VBUFFER	$V[6].x = 1.0, V[6].z = \text{ALU}.w$	LIGHT5 DISTANCE VECTOR
VLD6	VBUFFER	$V[7].x = 1.0, V[7].z = \text{ALU}.w$	LIGHT6 DISTANCE VECTOR
VLD7	VBUFFER	$V[8].x = 1.0, V[8].z = \text{ALU}.w$	LIGHT7 DISTANCE VECTOR
VC0	VBUFFER,TBUFFER	$V[9] = \text{ALU}, T[1] = \text{ALU}$	DIFFUSE COLOR
VC1	VBUFFER,TBUFFER	$V[10] = \text{ALU}, T[2] = \text{ALU}$	SPECULAR COLOR
VNRM	VBUFFER	$V[11] = \text{ALU}$	NORMAL VECTOR
VED2	VBUFFER	$V[12] = \text{ALU}$	EYE PLANAR DISTANCE VECTOR
TVW_NOP			NO VALID OUTPUT.

FIG. 10

MICROCODE FIELD	BITS	LOCATION	DELAY	DESCRIPTION
oa	6	0:5	2	OUTPUT BUFFER WRITE ADDRESS
ra	3	6:8	0	RLU READ ADDRESS
rwm	4	9:12	2	RLU WRITE MASK
rwa	3	13:15	2	RLU WRITE ADDRESS
ilu	2	16:17	2	ILU OPERATION
alu	4	18:21	1	ALU OPERATION
ais	2	22:23	1	ALU SIGN CONTROL
aia	1	24	1	ALU INPUT A MUX
mlu	3	25:27	0	MLU OPERATION
mib	2	28:29	0	MLU INPUT B MUX
mia	2	30:31	0	MLU INPUT A MUX
va	3	32:34	0	INPUT BUFFER READ ADDRESS
ce	1	35	0,2	CONTEXT MEMORY READ/WRITE
ca	6	36:41	0,2	CONTEXT MEMORY ADDRESS
mr	2	42:43	0	MLU INPUT VECTOR ROTATE

FIG. 11

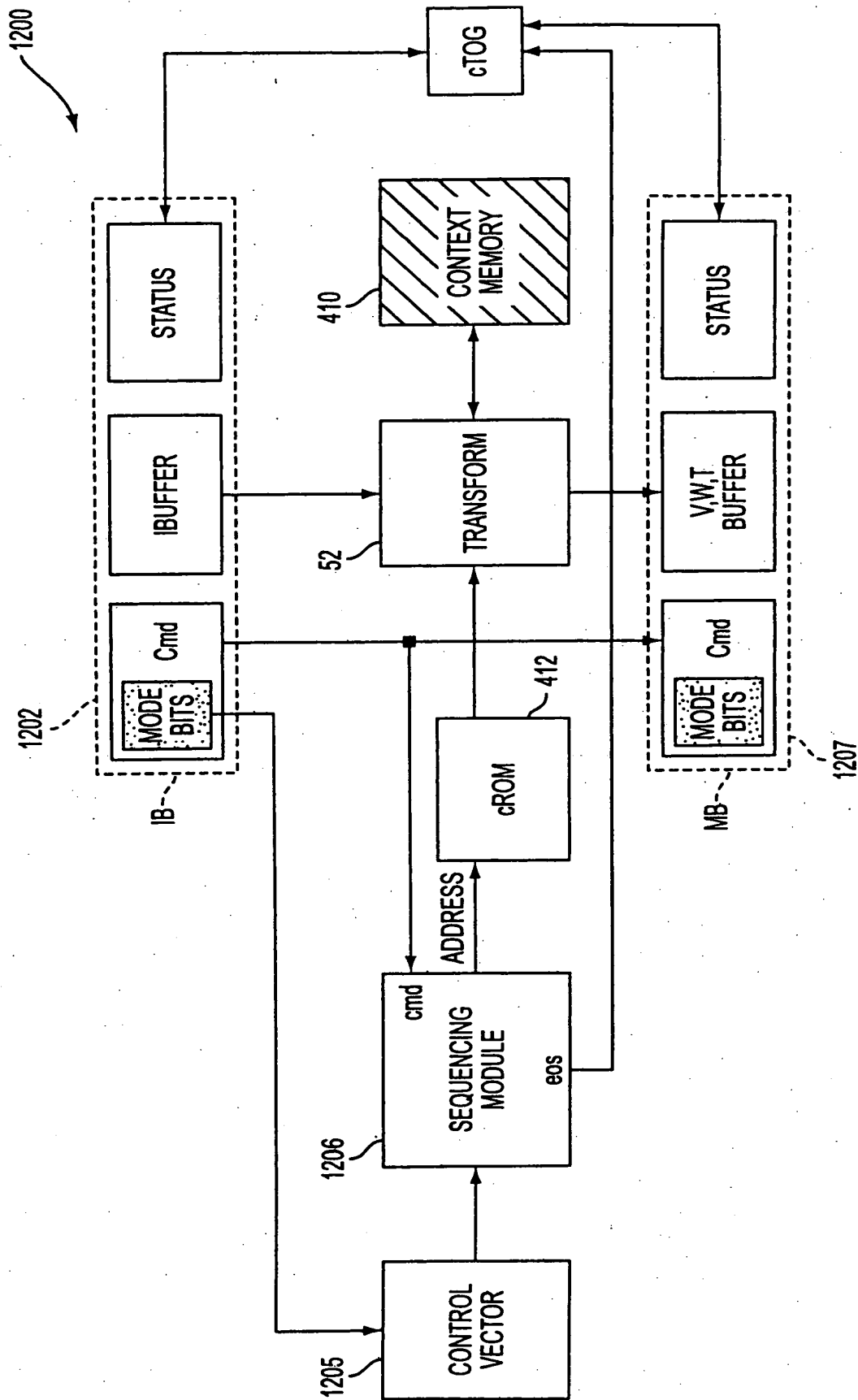


FIG. 12

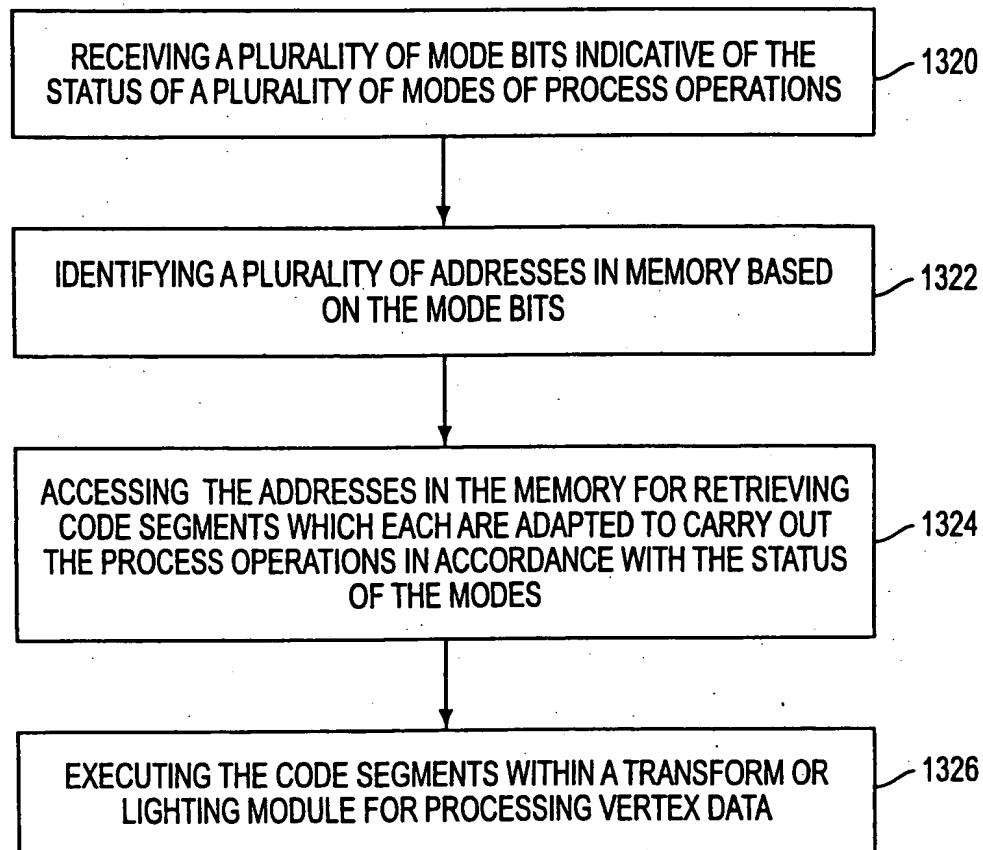


FIG. 13



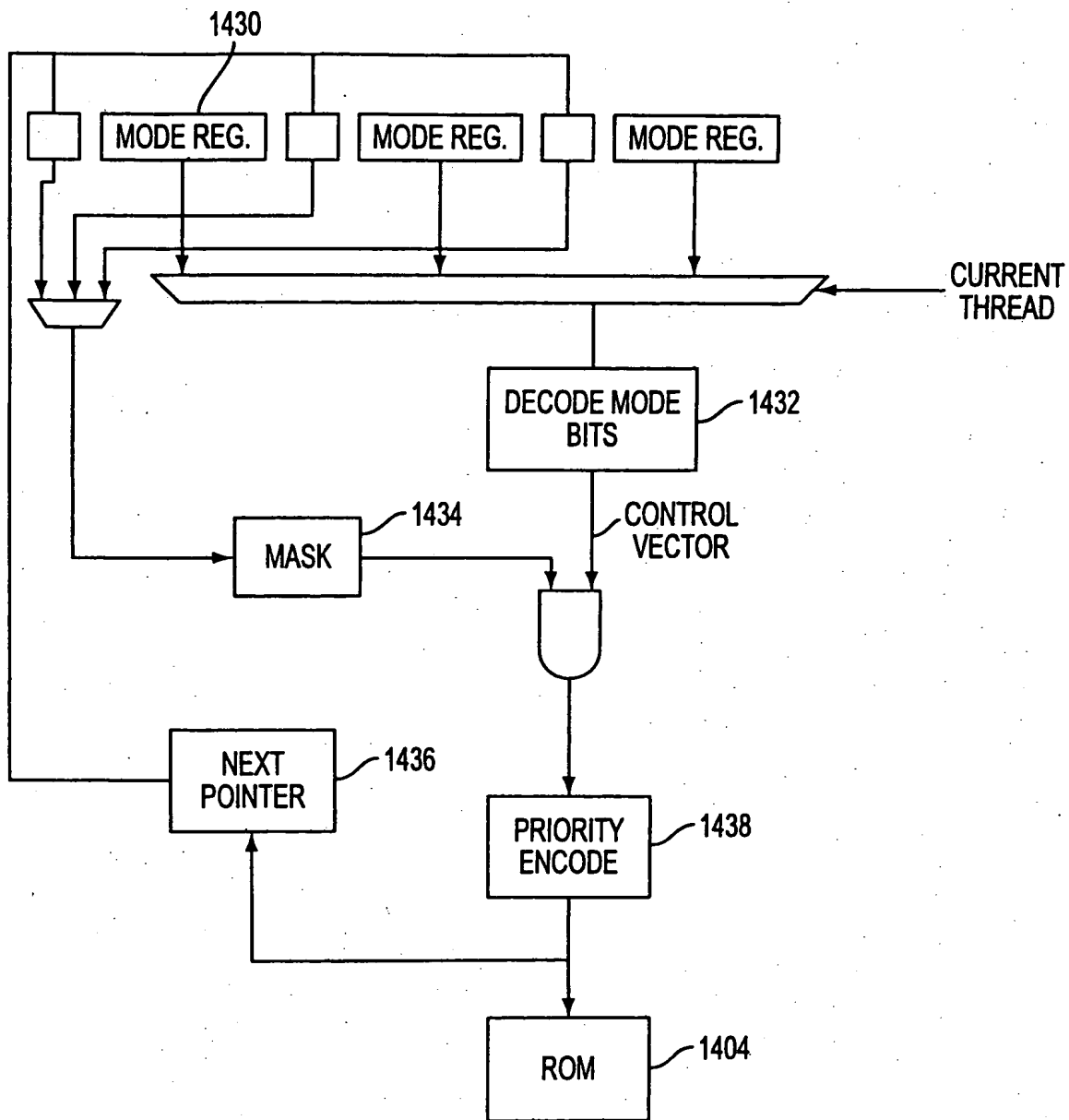


FIG. 14

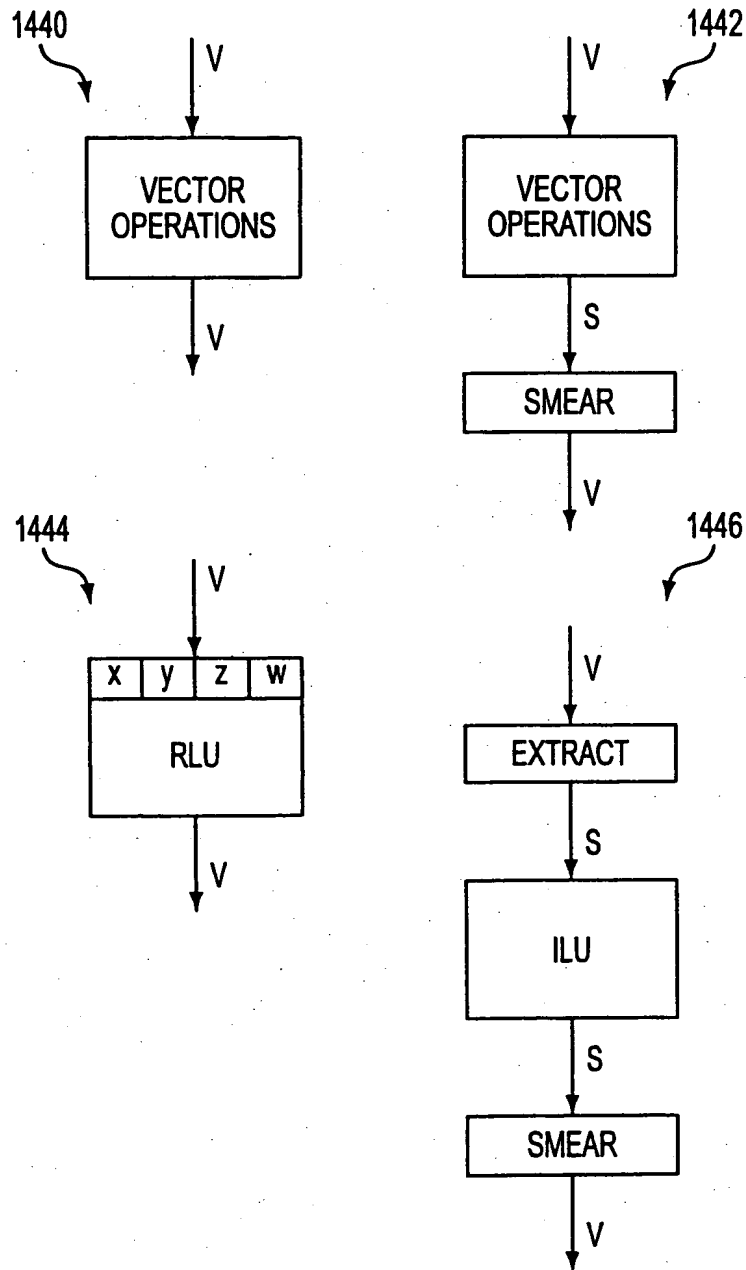


FIG. 14A

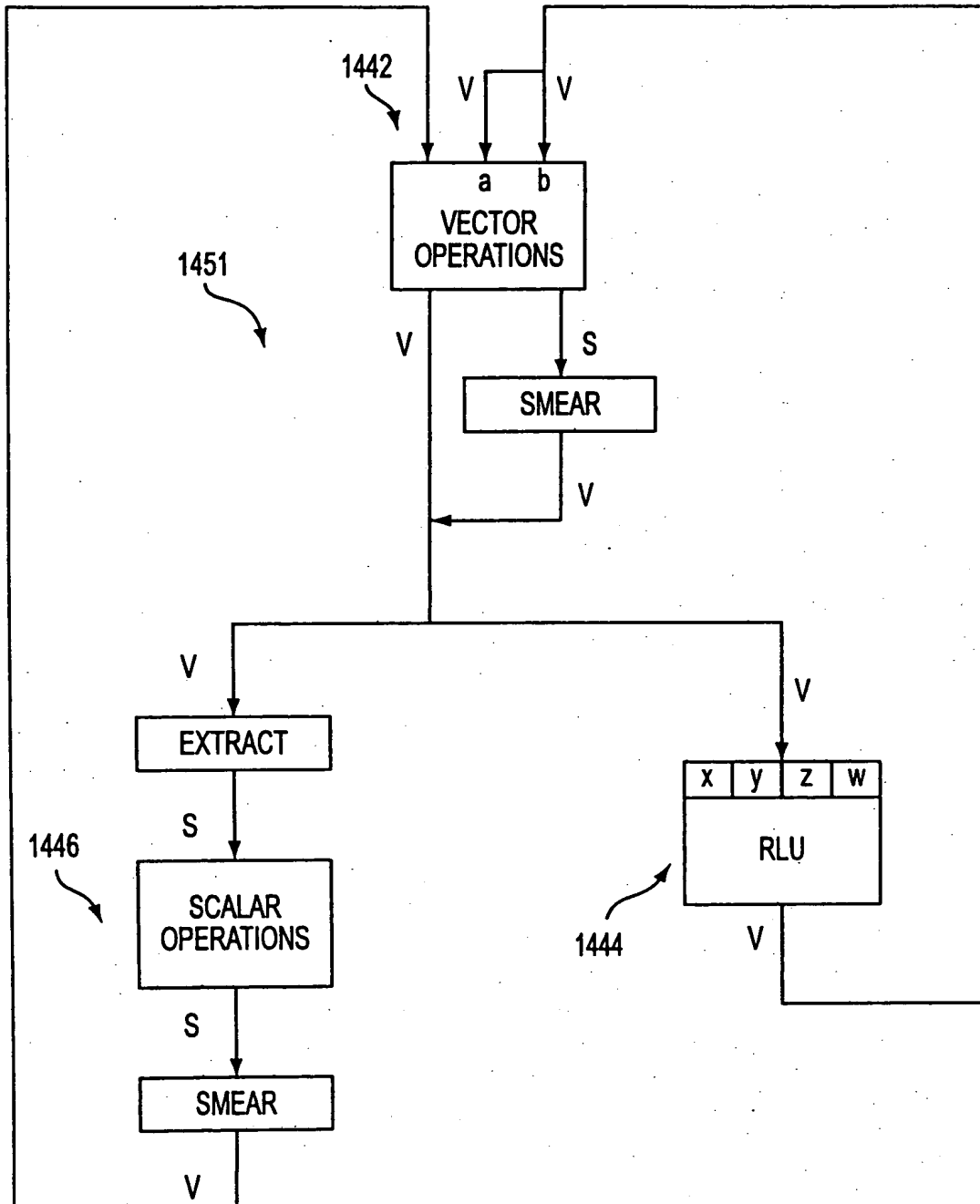


FIG. 14B

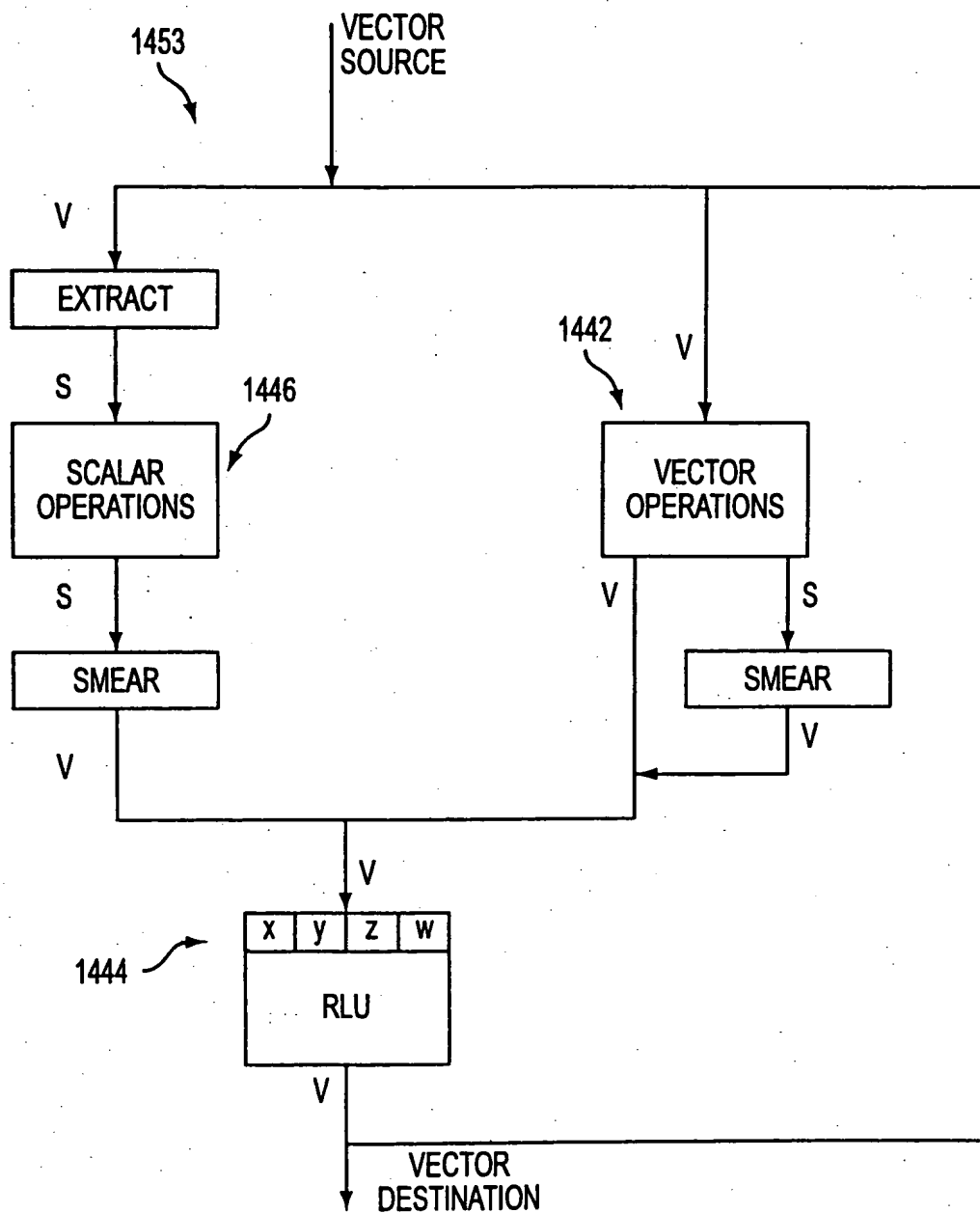


FIG. 14C

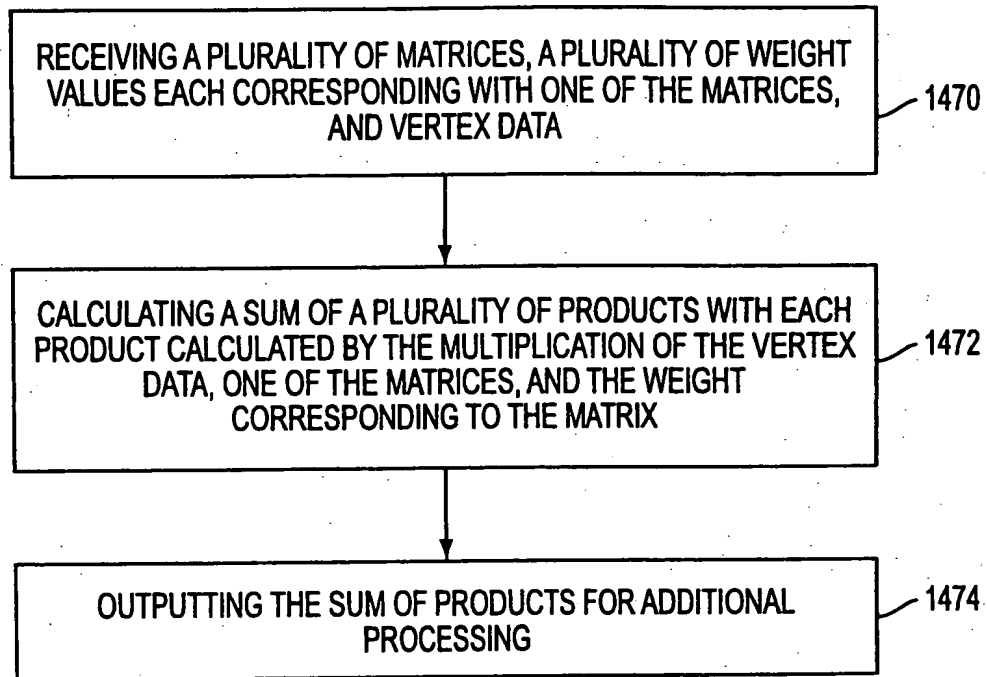


FIG. 14D

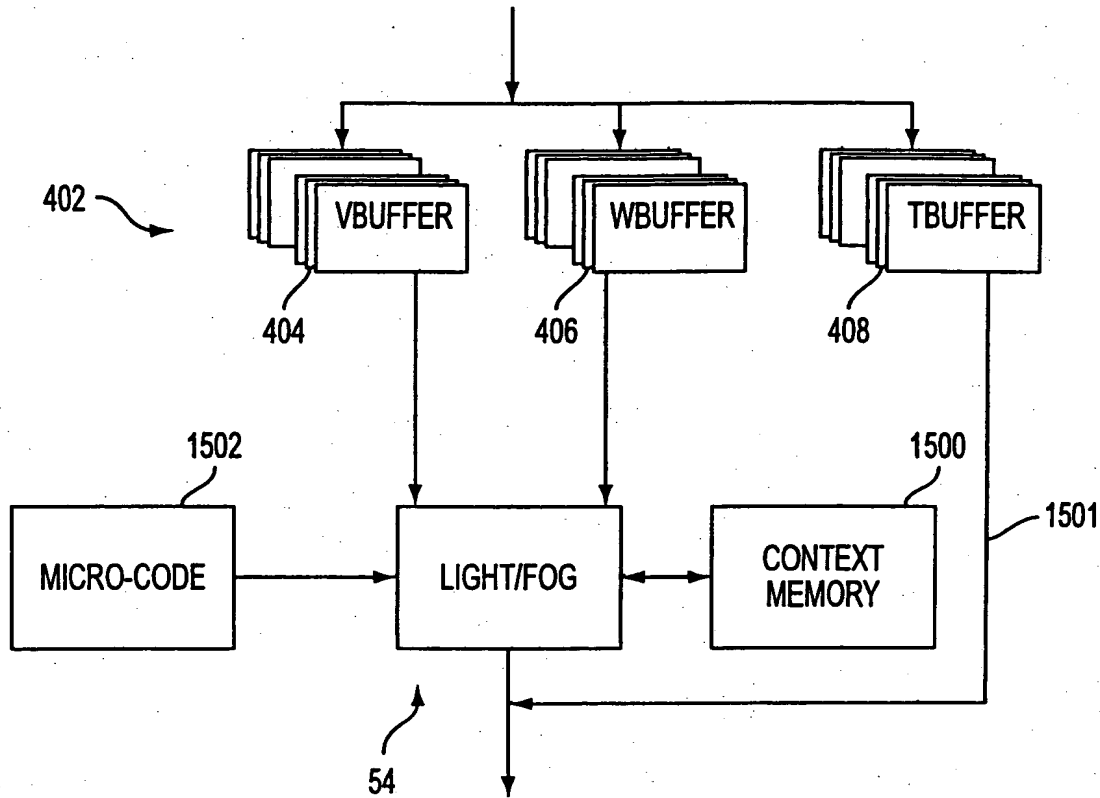
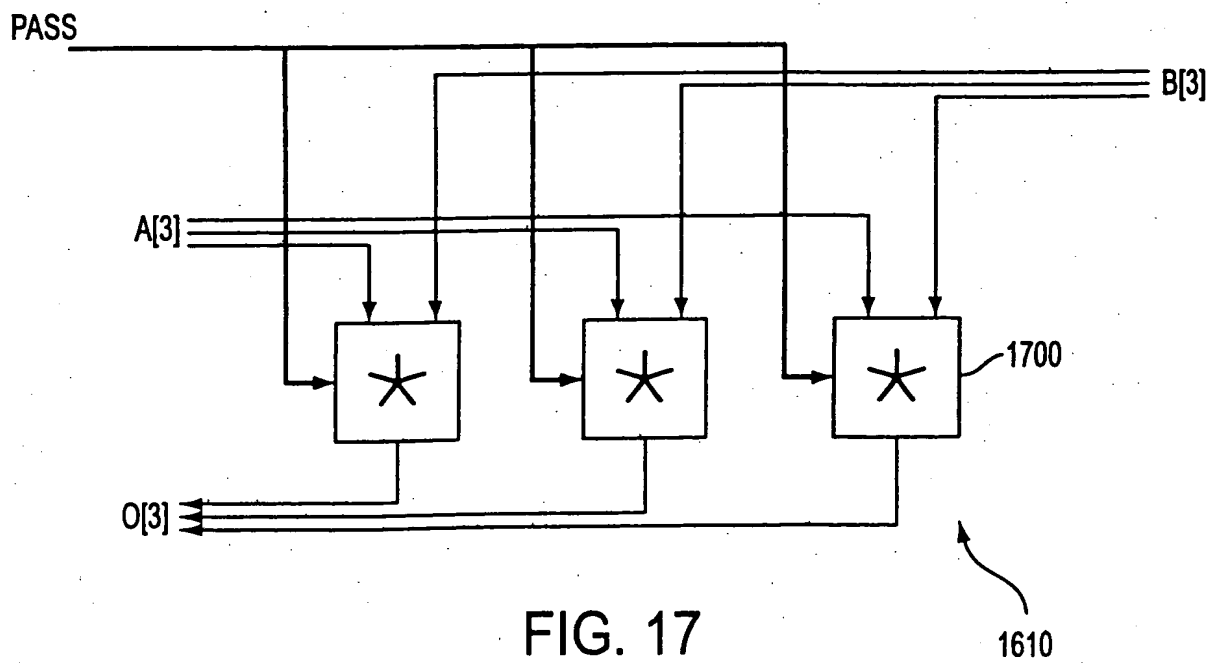
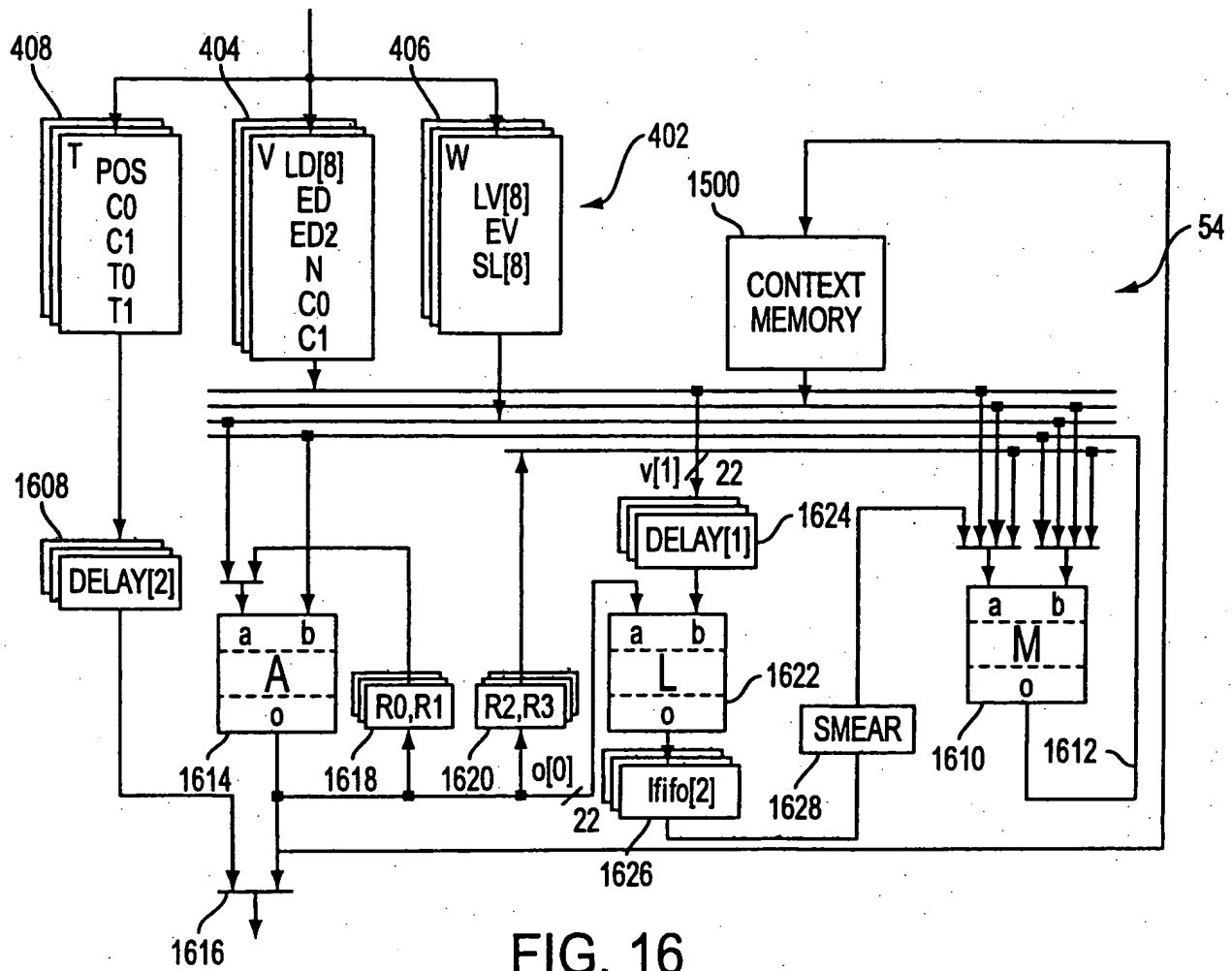


FIG. 15



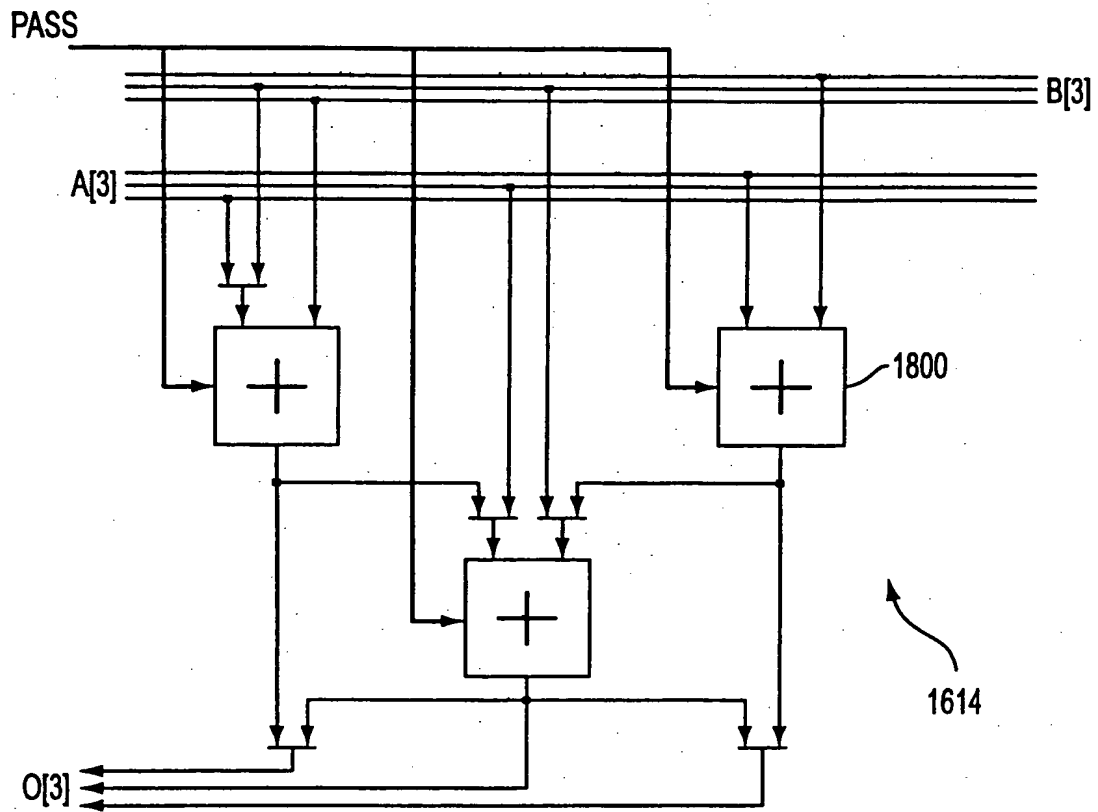


FIG. 18

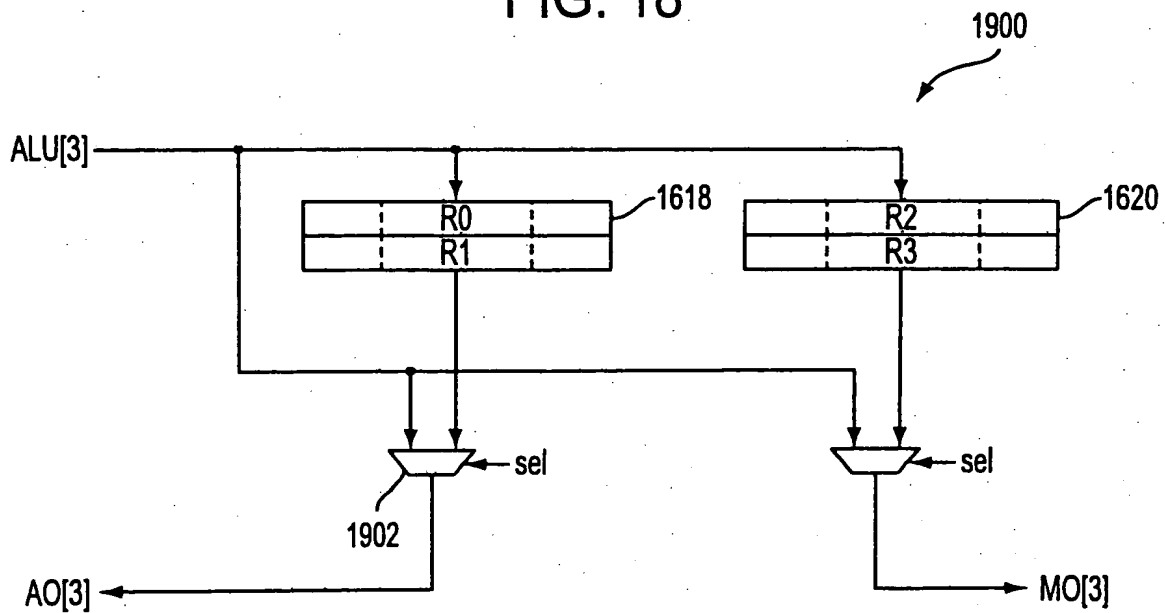
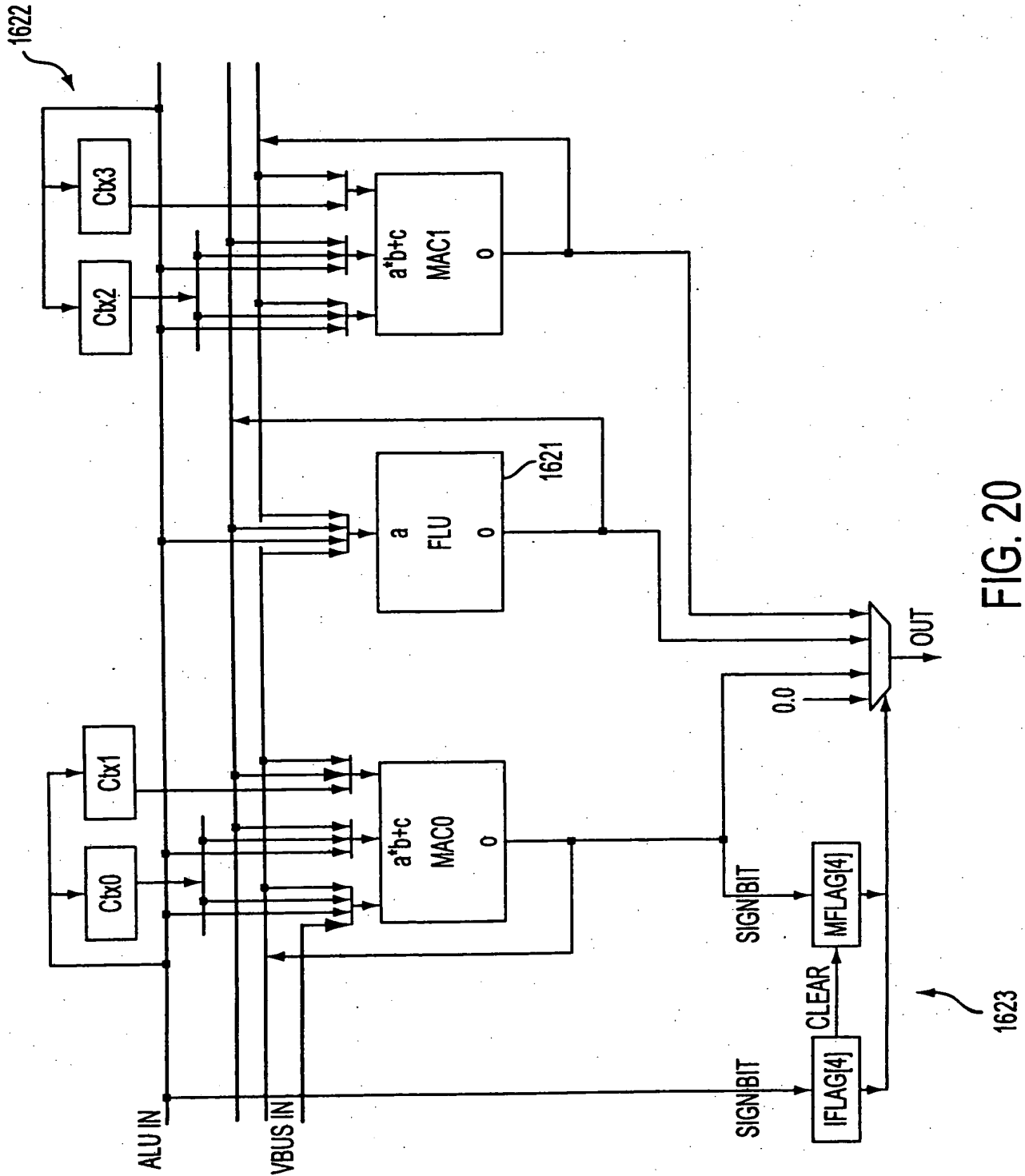


FIG. 19





NAME	REGISTER	DESCRIPTION
Z	IFLAG	CLEAR FLAG. SETS IFLAG AND MFLAG TO 0.
C	IFLAG	SPOTLIGHT CONE FLAG. SET IF VERTEX IS OUTSIDE SPOTLIGHT CONE.
S	IFLAG	SPECULAR2 FLAG. SET IF SPECULAR CONTRIBUTION IS NEGATIVE.
D	IFLAG	DIFFUSE FLAG. SET IF DIFFUSE TERM IS NEGATIVE.
	MFLAG	
U	MFLAG	SPOTLIGHT CONE ATTENUATION FLAG. SET IF SPOTLIGHT CONE ATTENUATION CONTRIBUTION IS NEGATIVE.
T	MFLAG	SPECULAR FLAG. SET IF SPECULAR CONTRIBUTION IS NEGATIVE.
R	MFLAG	RANGE FLAG. SET IF VERTEX IS TOO FAR AWAY FROM THE LIGHT.

FIG. 21

MICROCODE FIELD	BITS	LOCATION	DELAY	DESCRIPTION
oa	3	0:2	2	OUTPUT ADDRESS
rwe	1	3	2	RLU WRITE ENABLE
rwa	2	4:5	2	RLU WRITE ADDRESS
R23	1	6	0	RLU (MLU) READ ADDRESS
R01	1	7	1	RLU (ALU) READ ADDRESS
aia	1	8	1	ALU INPUT A MUX
alu	2	9:10	1	ALU OPERATION
mib	2	11:12	0	MLU INPUT B MUX
mia	2	13:14	0	MLU INPUT A MUX
mlu	2	15:16	0	MLU OPERATION
mwa	5	17:21	0	MLU WBUFFER READ ADDRESS
awa	5	22:26	1	ALU WBUFFER READ ADDRESS
va	4	27:30	0	VBUFFER READ ADDRESS
os	2	31:32	2	LLU OUTPUT ADDRESS
frm	6	33:38	2	FLAG REGISTER MASK
mfe	1	39	2	MFLAG WRITE ENABLE
mfa	2	40:41	2	MFLAG WRITE ADDRESS
ife	1	42	2	IFLAG WRITE ENABLE
ifa	2	43:44	2	IFLAG WRITE ADDRESS
fia	2	45:46	2	FLU INPUT A MUX
flu	3	47:49	2	FLU OPERATION
M1c	1	50	2	MAC1 INPUT C MUX
M1b	2	51:52	2	MAC1 INPUT B MUX
M1a	2	53:54	2	MAC1 INPUT A MUX
M0c	2	55:56	2	MAC0 INPUT C MUX
M0b	2	57:58	2	MAC0 INPUT B MUX
M0a	2	59:60	2	MAC0 INPUT A MUX
ce	3	61:63	0,2	CONTEXT MEMORY READ/WRITE ENABLE
ca	6	64:69	0,2	CONTEXT MEMORY ADDRESS
C3a	4	70:73	2	CONTEXT3 MEMORY ADDRESS
C2a	4	74:77	2	CONTEXT2 MEMORY ADDRESS
C1a	5	78:82	2	CONTEXT1 MEMORY ADDRESS
C0a	2	83:84	2	CONTEXT0 MEMORY ADDRESS

FIG. 22

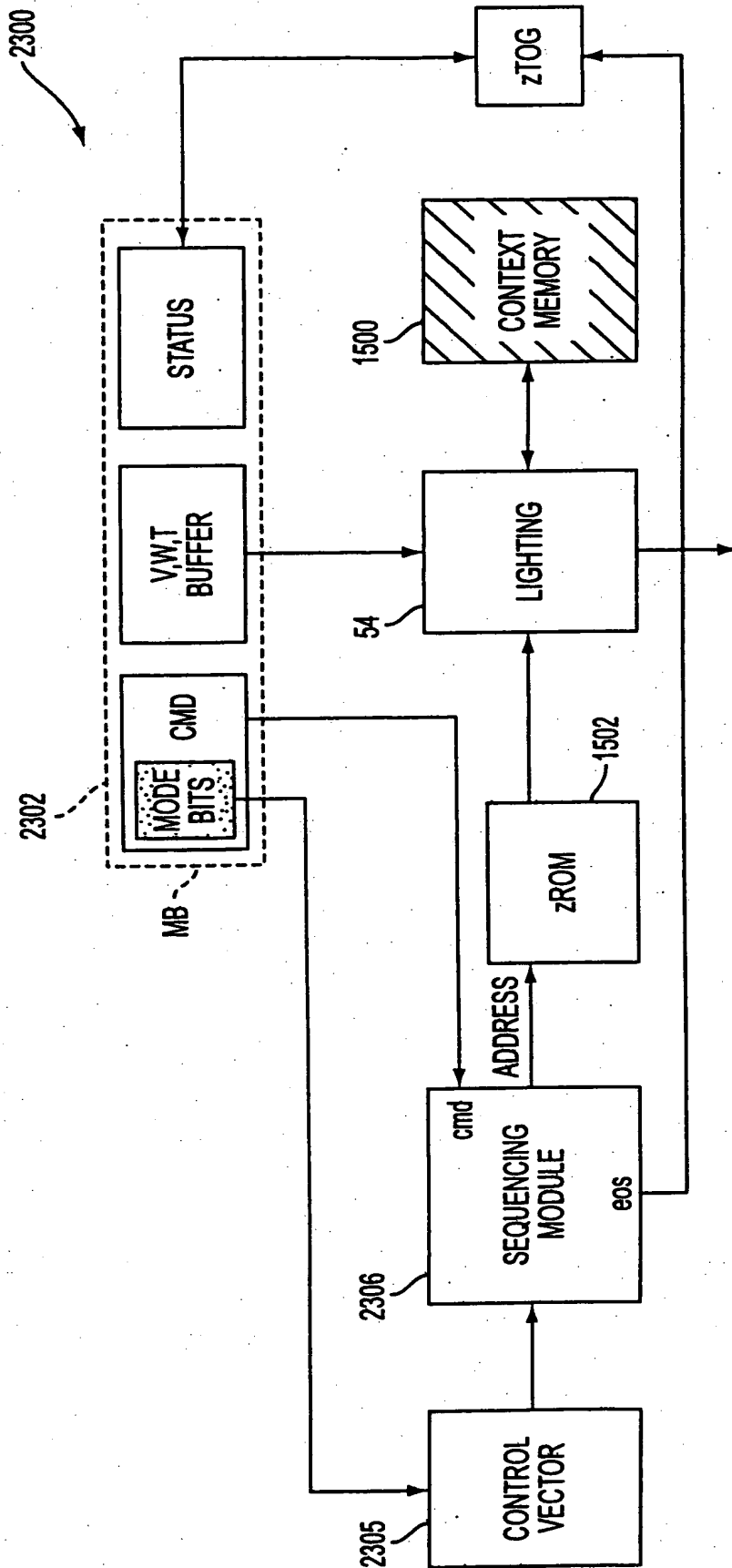


FIG. 23

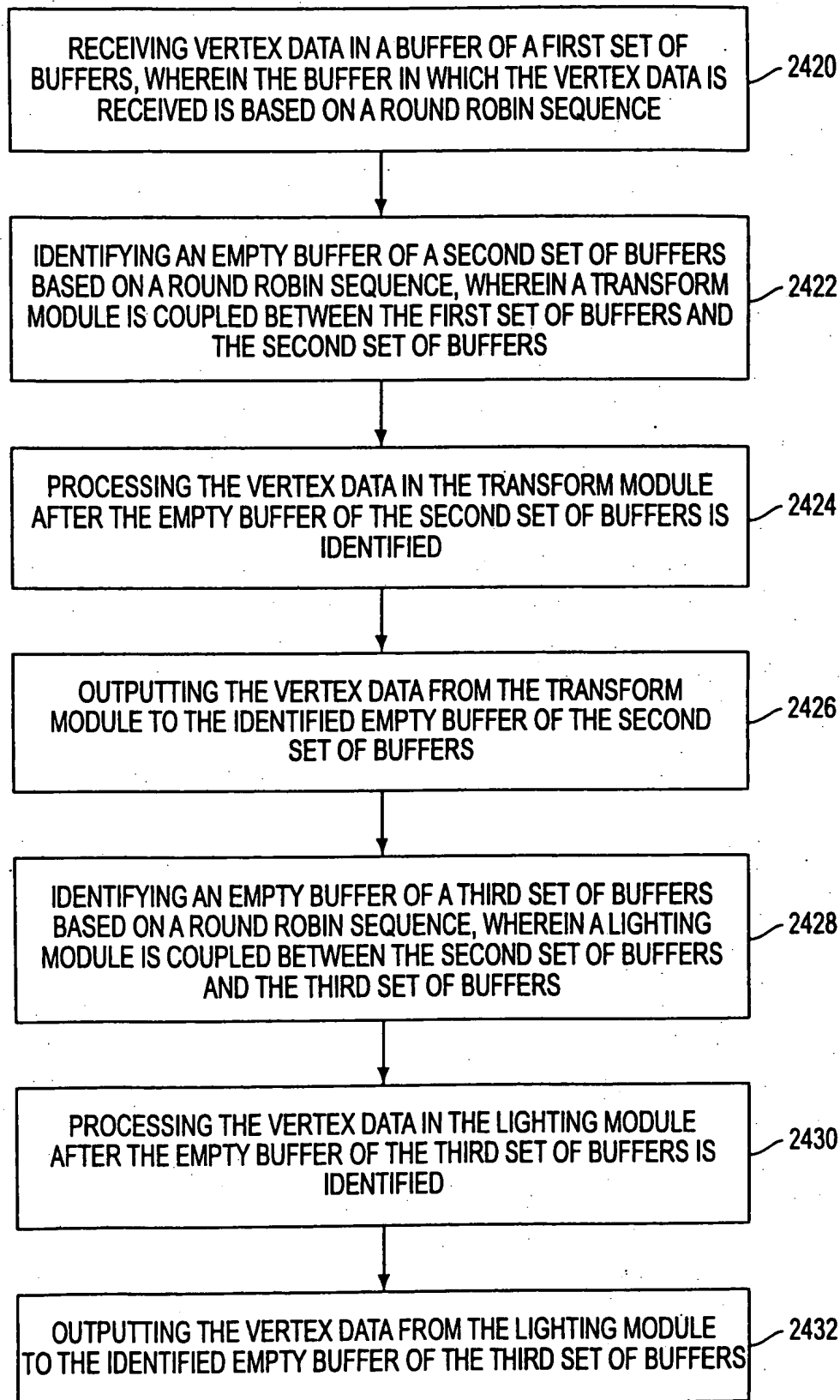


FIG. 24

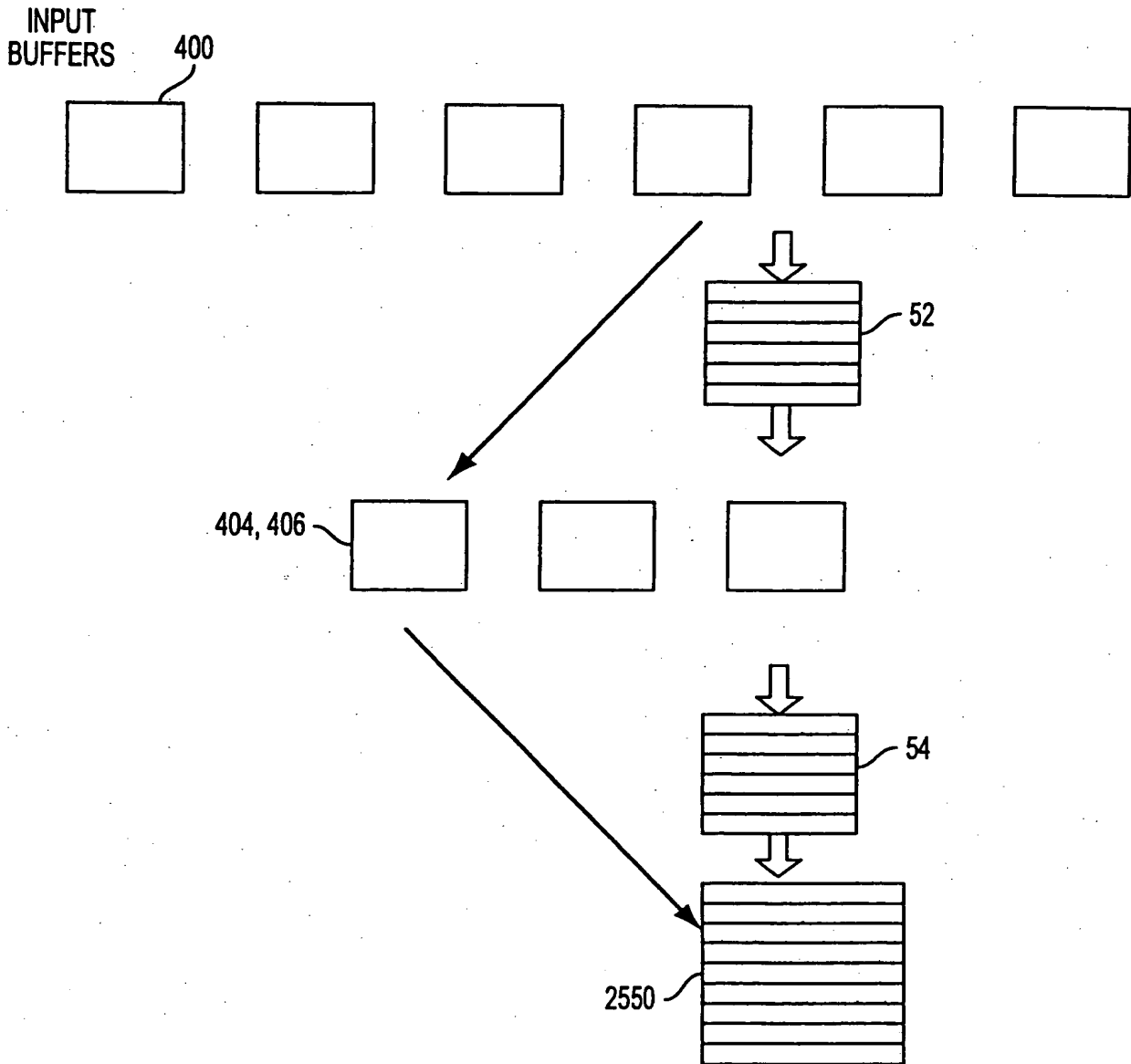


FIG. 25

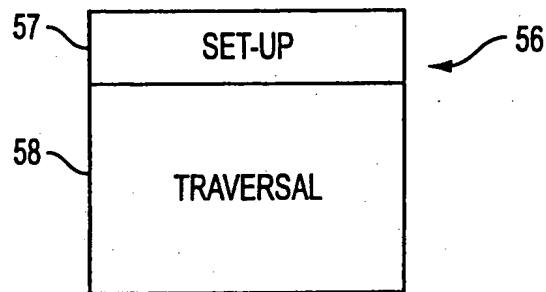


FIG. 25B

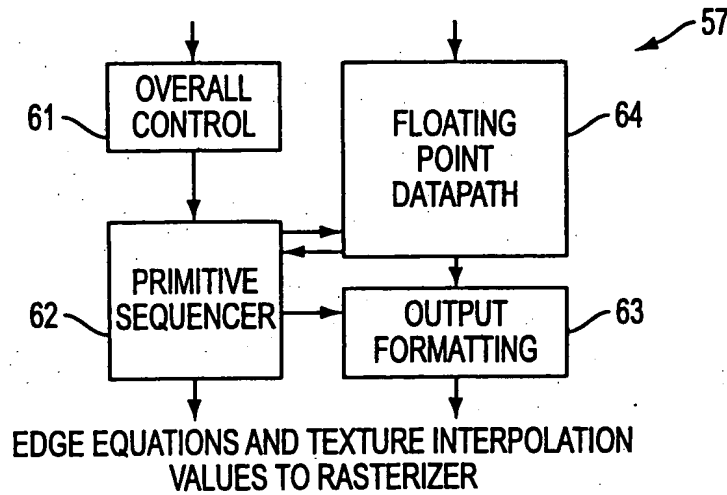


FIG. 26

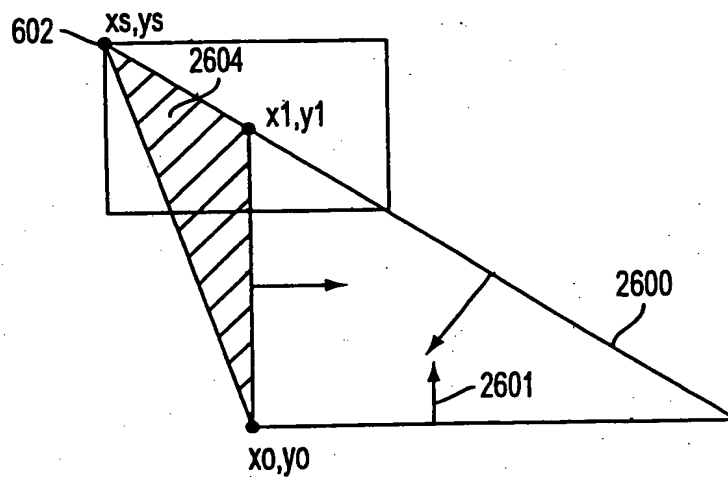


FIG. 26A



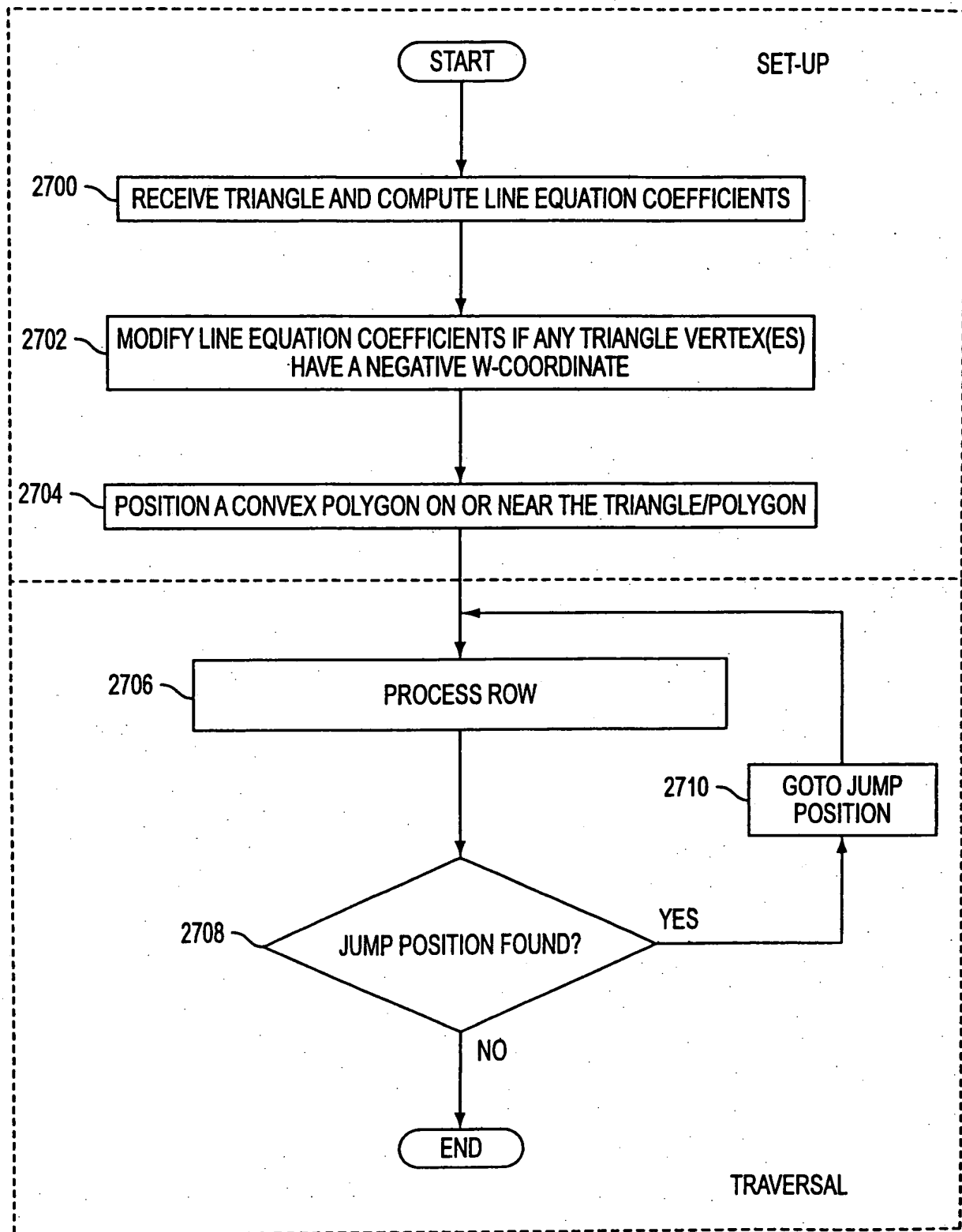


FIG. 27

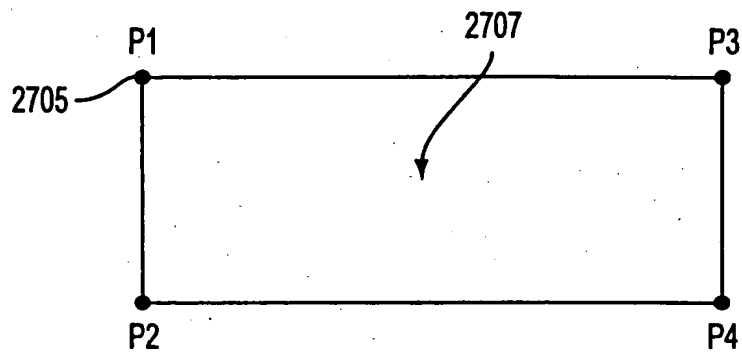
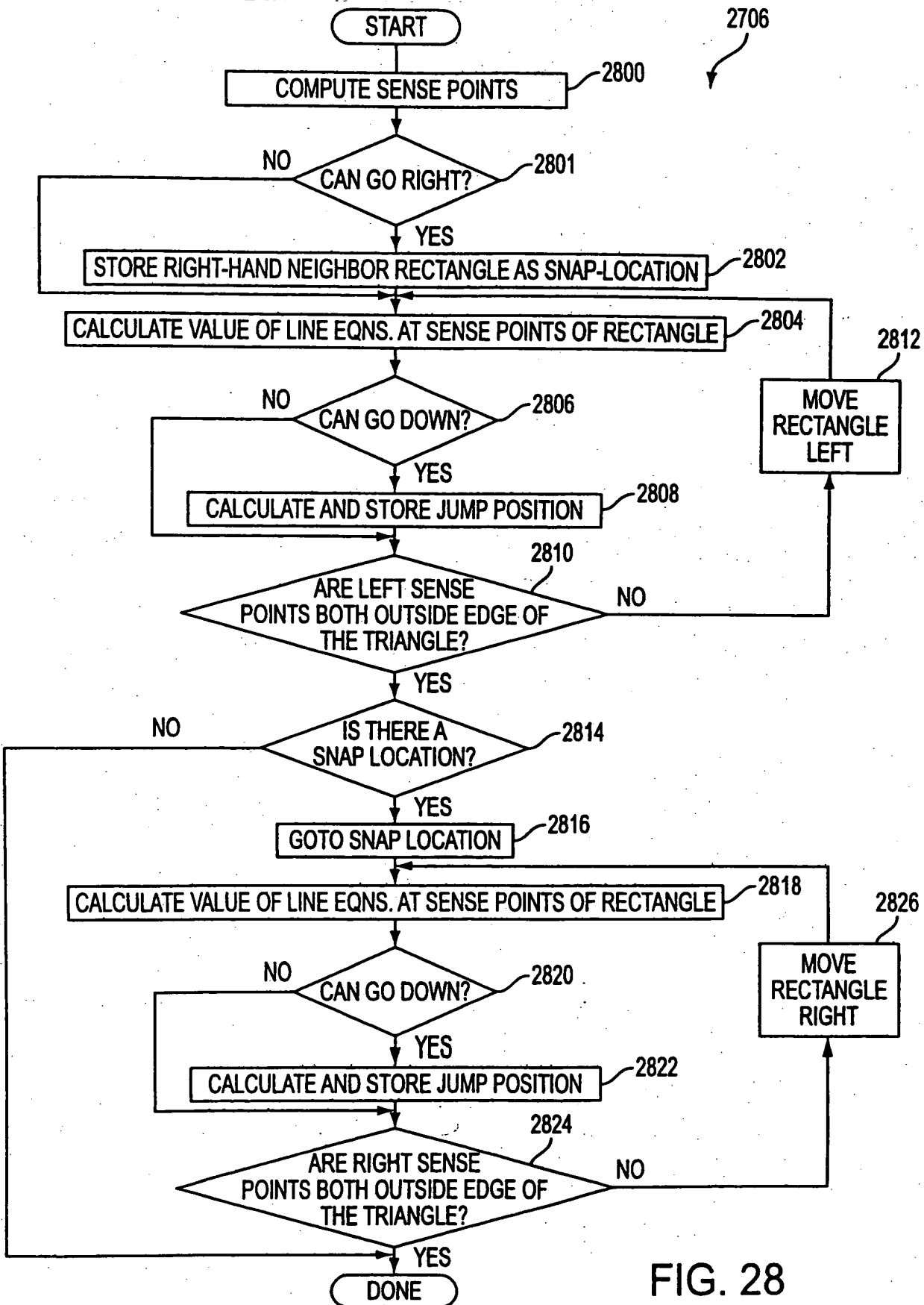


FIG. 27A



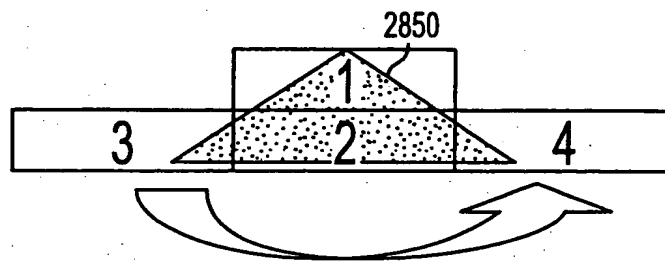


FIG. 28A

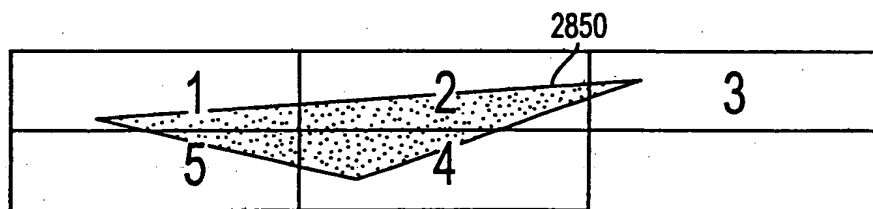


FIG. 28B

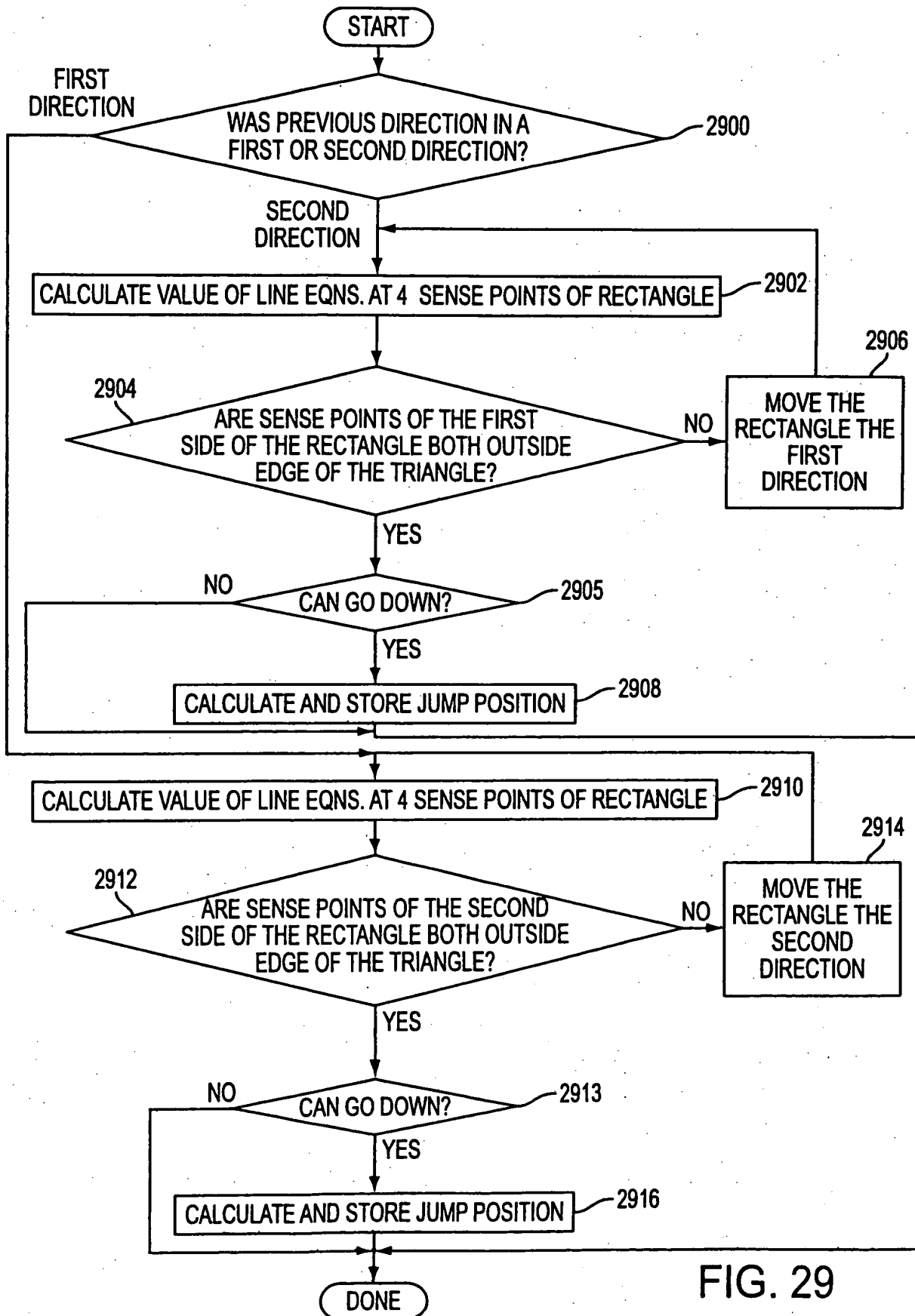


FIG. 29

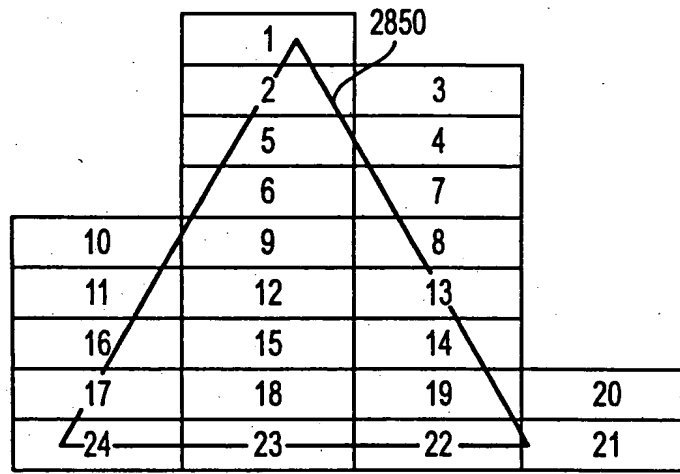


FIG. 29A

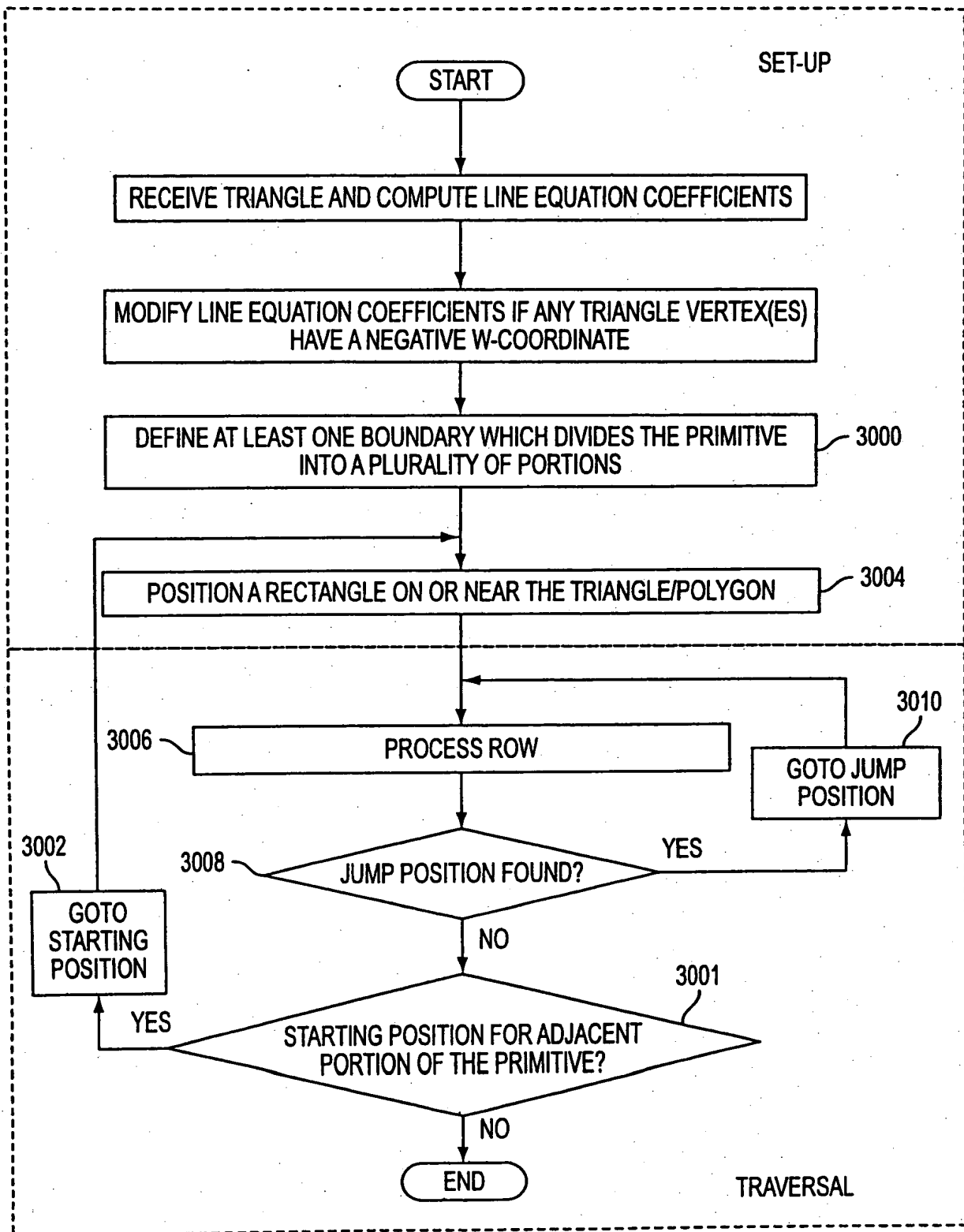


FIG. 30

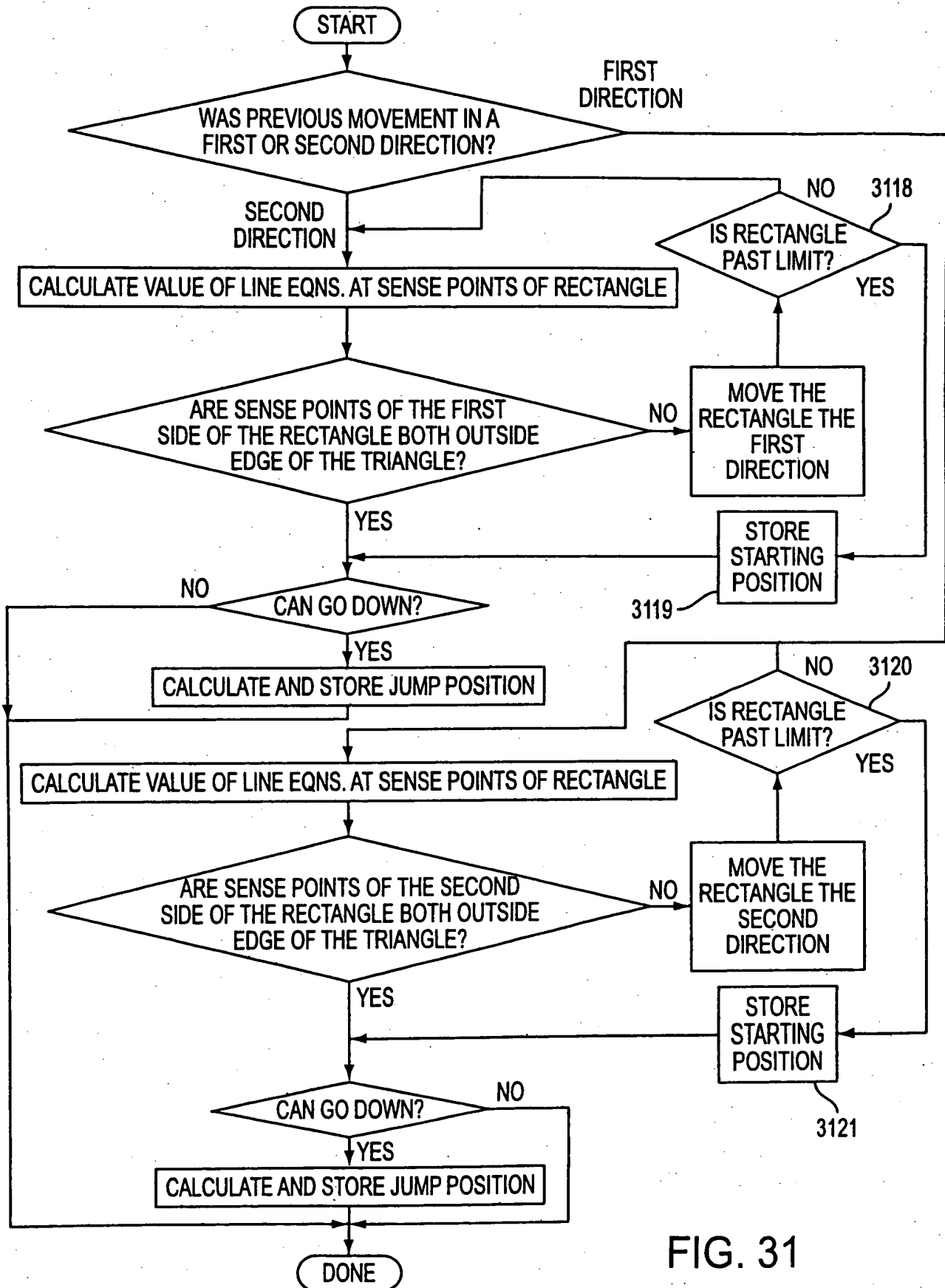


FIG. 31



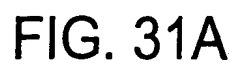


FIG. 31A

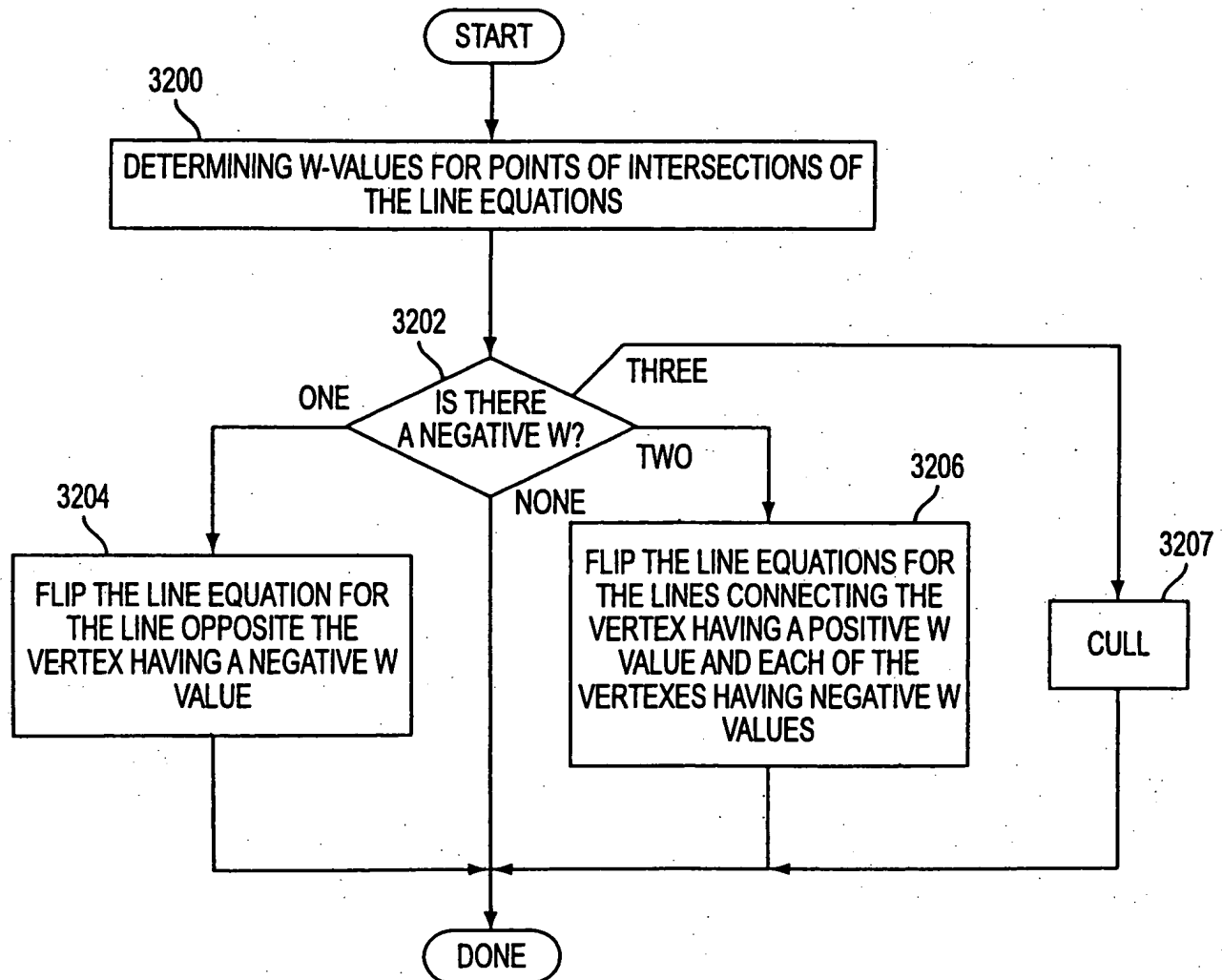


FIG. 32

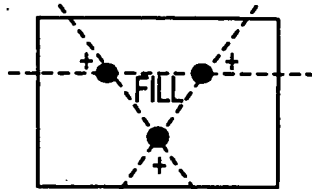


FIG. 32A

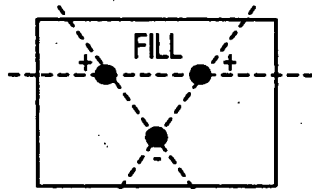


FIG. 32B

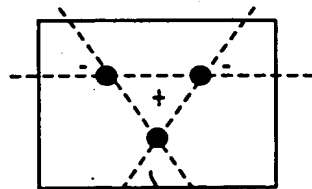


FIG. 32C